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AVIATION WEEK

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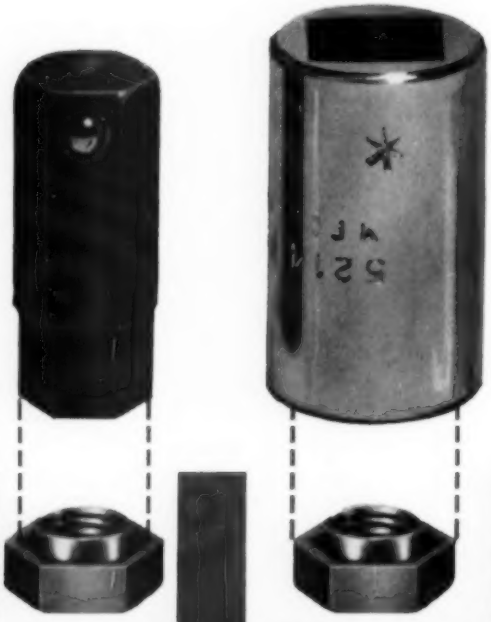

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HEX NUTS

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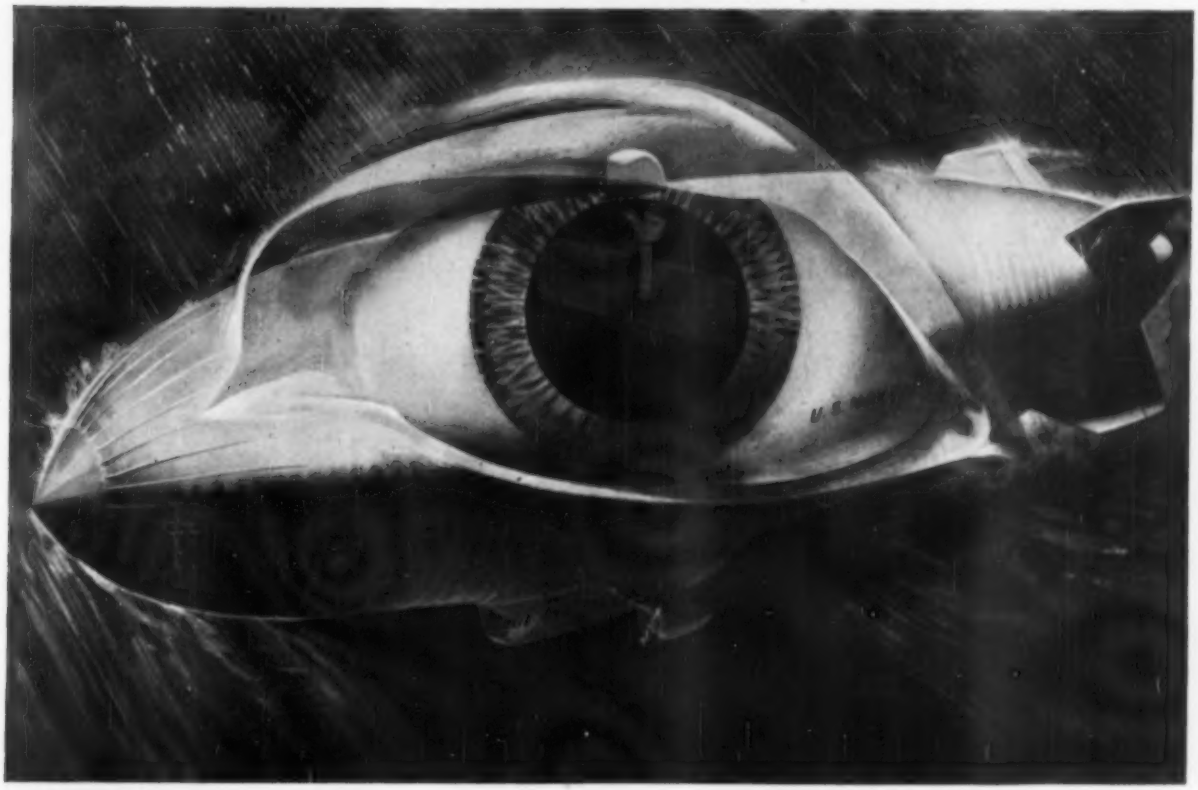

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It paves the way for new "Flying Eyes" which will see farther, detect quicker, reveal what they see more *clearly* than any other airborne sentry. The height-finding device in the radome atop its envelope enables the airship to report altitude as well as direction and range of *any aggressor who would seek to strike us through the skies.*

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This modified Goodyear ZPG-2W airship is a major step in a new concept of lighter-than-air development which will expand the effectiveness, scope and dependability of our defense network at a minimum expense of money and man power.

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Scintilla Division of Bendix Aviation Corporation designs and manufactures complete ignition systems for the most modern and powerful turbojet and turboprop engines. An ignition system, incorporating the benefits of years of ignition design experience, is provided for the Pratt & Whitney Aircraft J-75 turbojet—described as "the most powerful production turbojet engine known to exist in the free world".

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AVIATION CALENDAR

Sept. 19-20—Business Aircraft Operations Symposium & Eighth Annual P&WA-Airwork Engine Operation and Maintenance Forum, Millville Airport, N. J.

Sept. 21—Third Annual Helicopter Air Display, Bridgeport Municipal Airport, American Helicopter Society, New England Region, Bridgeport Municipal Airport, Conn. Rain date is Sept. 22.

Sept. 23-25—Fall Meeting American Society of Mechanical Engineers, Statler Hotel, Hartford, Conn.

Sept. 25—Pratt & Whitney Aircraft Engine Maintenance and Operation Forum, sponsored by Southwest Airmotive Co., Melrose Hotel, Dallas, Tex.

Sept. 26-27—Fifth Michigan Aeronautics Conference, jointly sponsored by University of Michigan Transportation Institute, Western Michigan University, and The Aero Club of Michigan, Alpena, Mich.

Sept. 28-29—North Central Regional Conference, Civil Air Patrol, Town House Hotel, Kansas City, Kans.

Sept. 30-Oct. 5—National Aeronautic Meeting, Aircraft Production Forum & Aircraft Engineering Display, Society of Automotive Engineers, Hotel Ambassador, Los Angeles.

Sept. 30-Oct. 5—International conference on rocket and earth satellite programs for the International Geophysical Year. For invitation write: Director of Information, U. S. National Committee, IGY, National Academy of Sciences, 2101 Constitution Ave., N. W., Wash., D. C.

Oct. 2-4—National Airports Conference, University of Oklahoma, Norman, Okla.

Oct. 2-4—Tenth Annual Meeting and Forum, National Business Aircraft Assn., Cosmopolitan Hotel, Denver, Colo.

Oct. 4—First Annual Awards Banquet, Society of Experimental Test Pilots, Beverly-Hilton Hotel, Los Angeles.

Oct. 6-8—International Northwest Aviation Council, 21st annual convention, Palliser Hotel, Calgary, Alberta, Canada.

Oct. 7-9—13th Annual National Electronics Conference, Hotel Sherman, Chicago, Ill.

(*Continued on page 6*)

AVIATION WEEK • SEPTEMBER 16, 1957

Vol. 67, No. 11

Published weekly with an additional issue in December by McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. Executive, Editorial, Advertising and Subscription offices: **McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Office, 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice President, Publication Division; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

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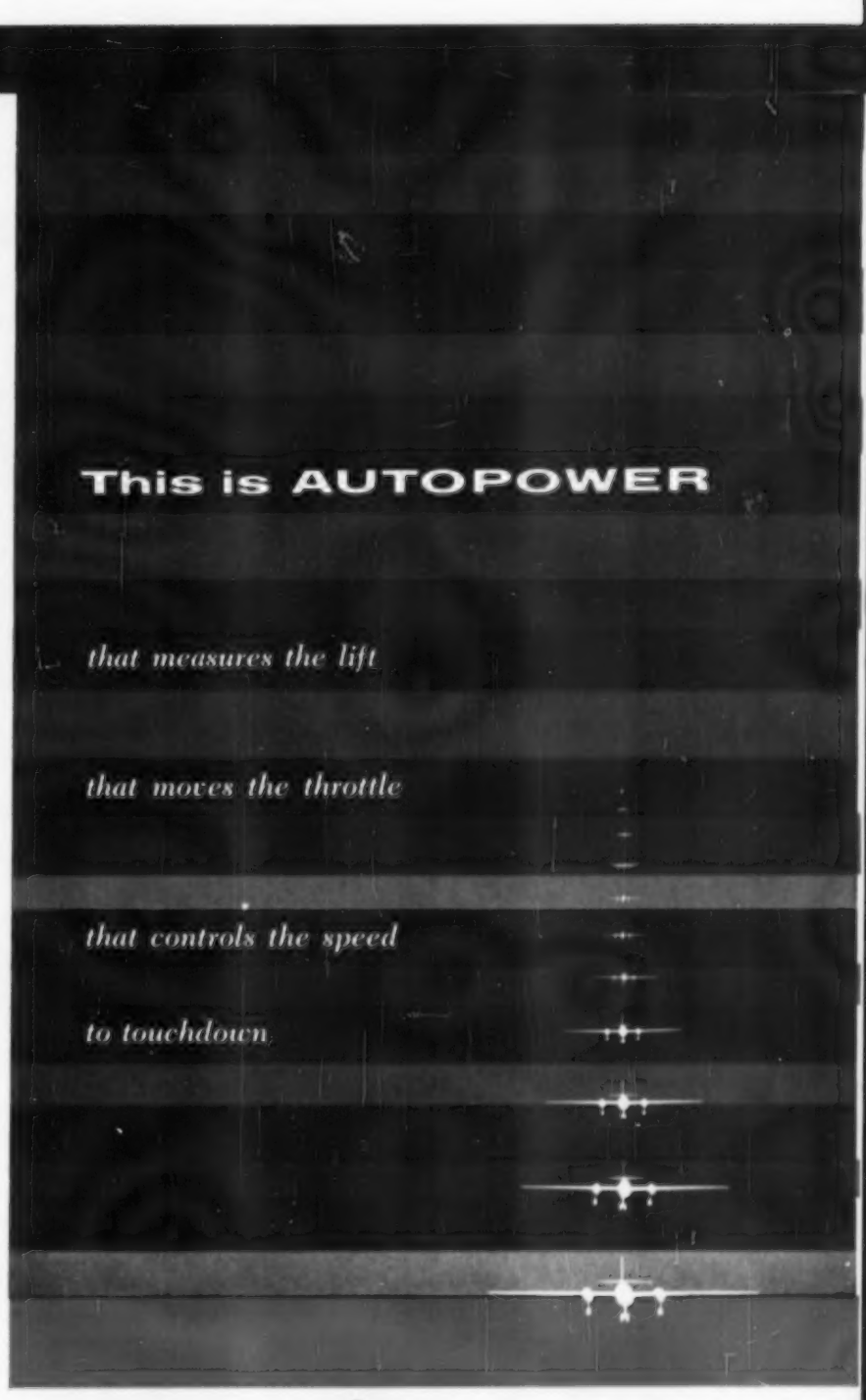

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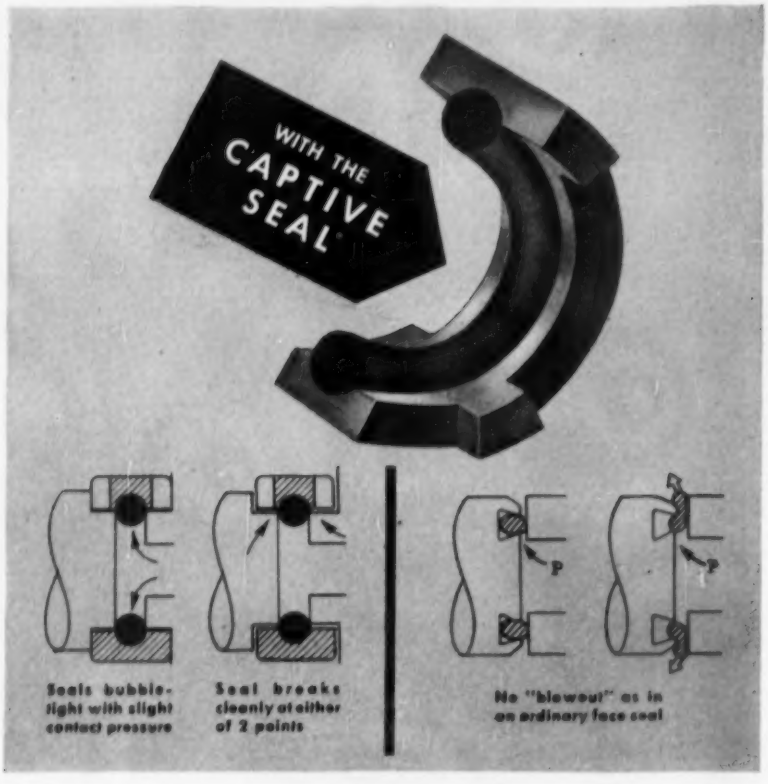
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AVIATION CALENDAR

(*Continued from page 5*)

Oct. 7-10—Triennial Inspection, Lewis Flight Propulsion Laboratory, Cleveland.

Oct. 7-12—Eighth Annual Congress, International Astronautical Federation, Barcelona, Spain. For details write: IAF, 35 Lowell Rd., Concord, Mass.

Oct. 8—Tenth Annual Airport Development and Operations Conference, Onondaga Hotel, Syracuse, N. Y.

Oct. 9-11—National Fall Convention, Society for Experimental Stress Analysis, El Cortes Hotel, San Diego, Calif.

Oct. 10-11—National Noise Abatement Symposium, Sherman Hotel, Chicago, Ill.

Oct. 16-18—Conference on Computers in Control, American Institute of Electrical Engineers, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J.

Oct. 16-18—1957 IRE Canadian Convention, Automotive Building, Exhibition Park, Toronto, Ont., Canada.

Oct. 17-18—13th Annual Convention, The Magnesium Association, Biltmore Hotel, New York.

Oct. 21-22—Canadian Aeronautical Institute-Institute of the Aeronautical Sciences Meeting, Montreal, Canada.

Oct. 21-23—Conference on new developments in the field of power, American Society of Mechanical Engineers, Americus Hotel, Allentown, Pa.

Oct. 21-25—45th National Safety Congress, Conrad Hilton Hotel, Chicago.

Oct. 24-25—Fourteenth Annual Display, Aircraft Electrical Equipment, Aircraft Electrical Society, Pan Pacific Auditorium, Los Angeles, Calif.

Oct. 28-31—Second Winter Meeting, American Nuclear Society, Henry Hudson Hotel, New York.

Oct. 28-29—Third Annual Meeting, Association of the U. S. Army, Sheraton-Park Hotel, Washington, D. C.

Oct. 28-30—Annual East Coast Conference on Aeronautical and Navigational Electronics, Fifth Regiment Armory, Baltimore, Md.

Oct. 28-31—National Industrial Packaging & Handling Exposition, Atlantic City Convention Hall, N. J.

Oct. 30—Aviation Electrical Equipment Display, U. S. Grant Hotel, San Diego.

Oct. 31-Nov. 1—Fourth Annual Meeting, Professional Group on Nuclear Science, Henry Hudson Hotel, New York.

Nov. 2-8—Second World Metallurgical Congress & 39th National Metal Exposition & Congress, Palmer House, Hotel Sherman and International Amphitheatre, Chicago.

Nov. 4-8—Fourth Institute on Electronics in Management (automatic data processing system), The American University, 1901 F. St., Washington 6, D. C.

Nov. 5-7—Joint Military-Industry Guided Missile Reliability Symposium (limited to those with Secret security clearance), Naval Air Missile Test Center, Pt. Mugu.

Nov. 6-8—Third Annual Symposium on Aeronautical Communications, Hotel Utica, Utica, N. Y.

Nov. 7-8—National Meeting, Weapons System Management, Institute of the Aeronautical Sciences, Statler-Hilton Hotel, Dallas, Tex.

BUILT TO STAND PUNISHMENT

Using tough, lightweight CONOLON 506

Solar Aircraft Company engineers were faced with a problem . . . how to aerodynamically enclose the "Mars" gas-turbine engine auxiliary electric-power generating units (APU's) to be mounted on Convair C-131B aircraft. The C-131B's so fitted were to be used for the in-flight testing of advanced airborne electronic equipment.

Housing the APU's required an aerodynamic pod built in two parts with multiple compound curvatures and drastically sharp bends. The materials problem presented was complex. The material selected had to withstand . . . temperatures of 400 F or even higher . . . contact with a special synthetic lube fluid for the turbine engine . . . high lead content exhaust fumes . . . ground handling abuses . . . aerodynamic wind loads . . . and severe abrasion because the pod was to be mounted only 12 inches above the runway.

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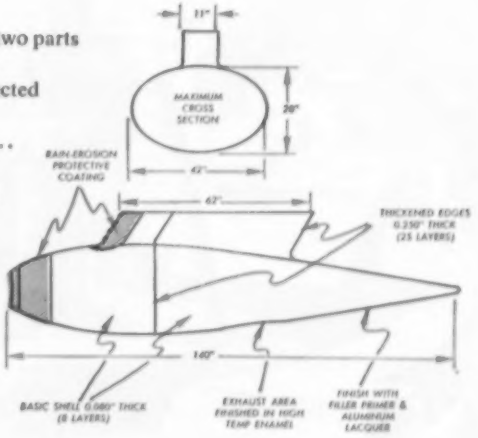

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Motor: 400 cycle 115V. single phase thermal protected explosion proof Western Gear motor; 10,000 RPM output speed; meets MIL-M-7969A specs. Actuator provides 100 RPM at 50 inch pounds normal rated load, 150 inch pounds maximum starting load. Available with limit switches to control number of revolutions of output shaft and slip clutch to provide for overload protection or prevent damage to driven equipment. Actuator meets MIL-A-8064 and MIL-E-5272 specs. Is equipped with emergency crank for hand operation. Can be supplied with AN connector. Total weight 3¾ lbs.

Linear Actuator Model 1965

Electromechanical ball bearing jackscrew powered through reduction gear box by 26 volt totally enclosed D.C. motor. Provision on gear box for manual operation through flexible drive shaft. Integral with unit are limit switches for accurate positioning and non-jamming mechanical stop at extend position of jackscrew to absorb full output of driving motor. Linear travel under normal operating load of 450 lbs. over a maximum operating stroke of 14.92 inches is 2.00 inches per second minimum, 3.00 inches maximum. Equipped with manual control system with provision for emergency hand crank operation. Weight is 12 lbs. 5 oz. This actuator is typical of a wide range of linear units capable of axial thrust loads from 100 to 100,000 pounds.

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1907 — First Air Force plane, the Wright Flyer, flew only 42 mph, had a range of about 50 miles. Intrepid pilots had few instruments, depended largely on luck, personal skill.

1957 — With round-the-world flight routine, today's Air Force crews have finest training and finest equipment nation can provide.

FIRST SUPERSONIC BOMBER NEEDS ONLY 3-MAN CREW

Electronic guidance equipment makes operation virtually automatic

This is an aggressor's eye view of SAC's "Hustler"—Convair's delta-winged B-58—world's first supersonic strategic bomber.

The "Hustler" is also the most nearly automatic airplane yet developed. It is equipped with newly developed Sperry electronic navigation and guidance systems which automatically direct it at speeds well above that of sound.

Advanced gyroscopes, electronic sensing elements and computers hold the plane on course for thousands of miles over uncharted regions. Continuously providing data for automatic correction of the smallest deviation from course, they perform in split-seconds complex calculations with precision and accuracy far beyond the capacity of human beings. These instruments even calculate the precise moment for release of the B-58's unique throw-away weapon pod.

This year the Air Force is celebrating its 50th anniversary. Weapons like the "Hustler", manned by the best-trained crews in aviation history, enable the Air Force to put real meaning into its slogan, "Guardian of Freedom", and make any would-be aggressor stop and think. For 47 years Sperry's work in gyroscopics, electronics, flight control and radar has helped build the strongest Air Force on earth.

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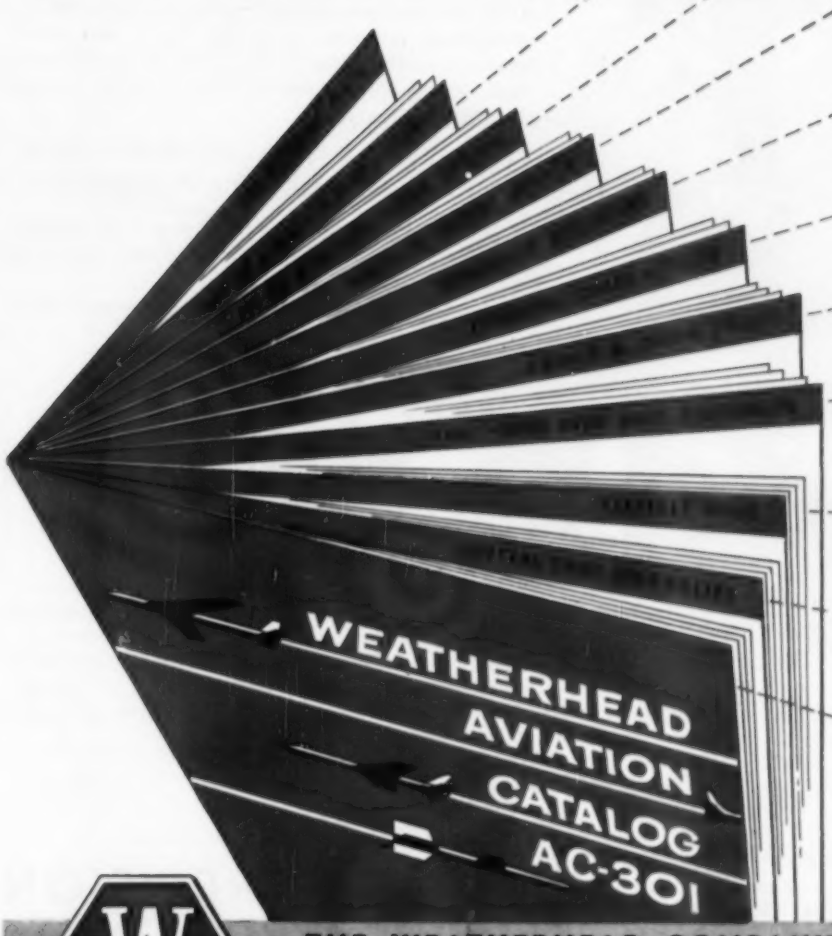

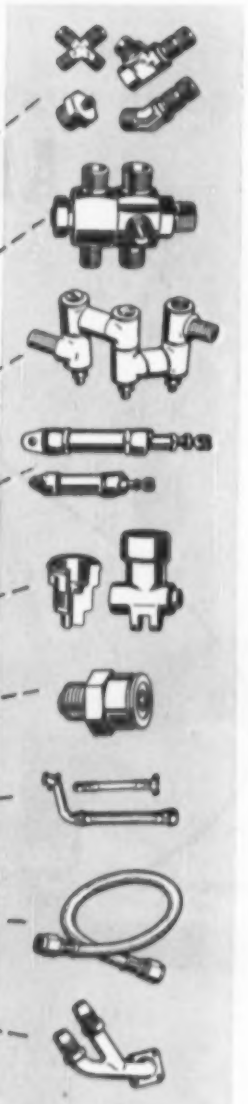

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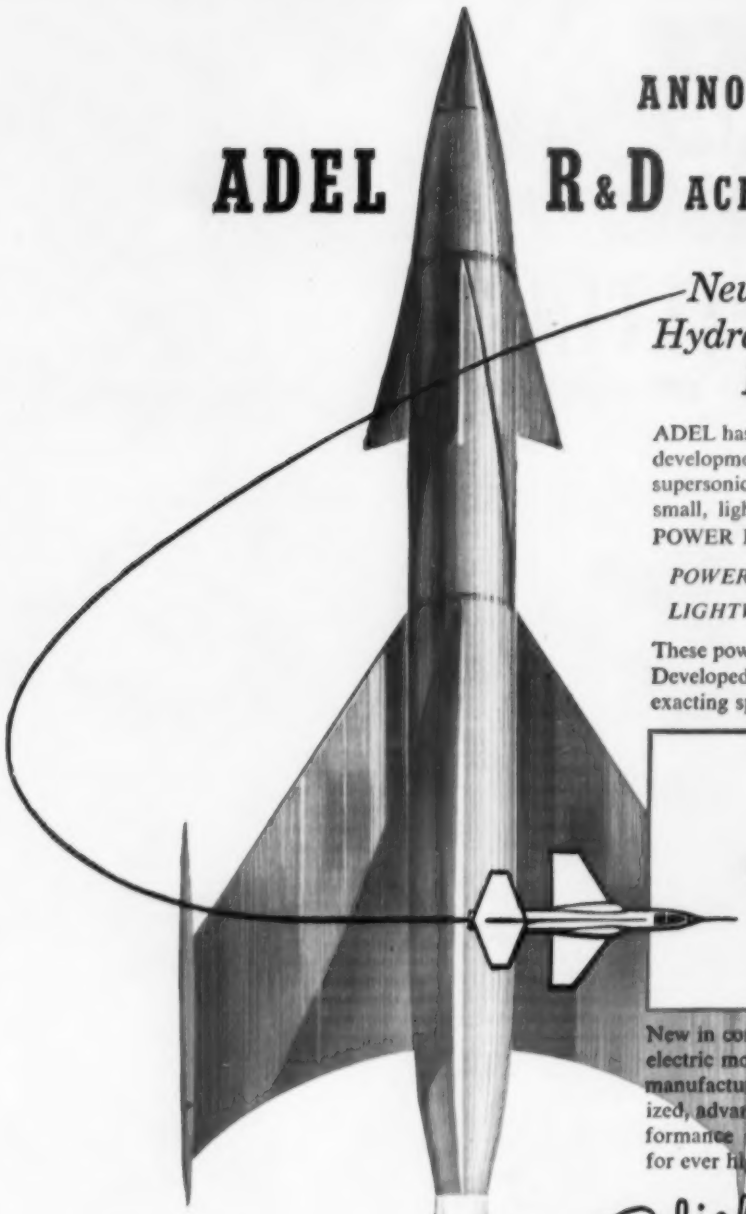

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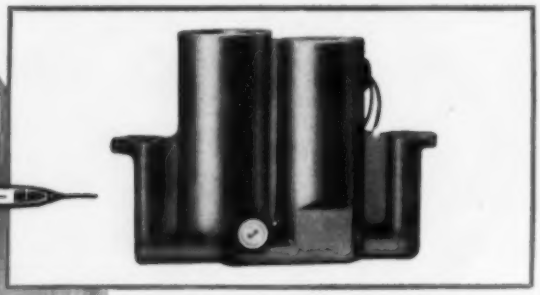

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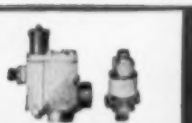
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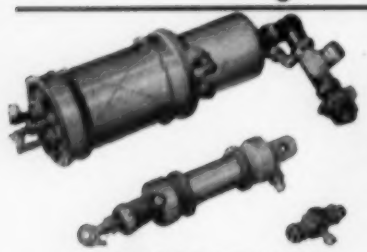

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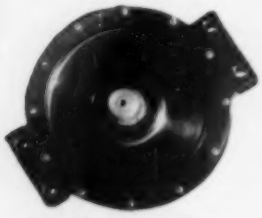
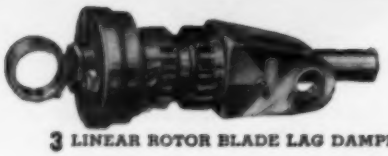
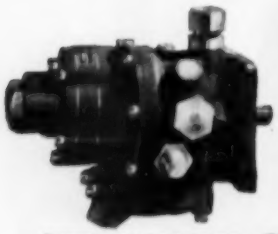


2 VISCOUS SHIMMY DAMPER



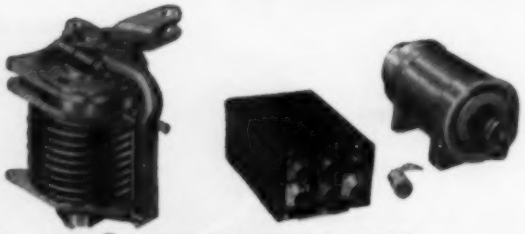
3 LINEAR ROTOR BLADE LAG DAMPER



4 HYDRAULIC PUMPS

5 ROTARY SHIMMY DAMPER

6 FLUTTER DAMPER



7 NOSE WHEEL STEER DAMPERS

8 ROTARY ACTUATORS

9 ROTARY DAMPERS

10 HYDRA SPRING

11 LINEAR FLUTTER DAMPER

WHATEVER YOUR REQUIREMENTS for hydraulic or vibration control equipment in aircraft... Houdaille is your best source. When original product designs are required, Houdaille will evaluate your needs and develop the *right* component for any application. Houdaille's extensive manufacturing facilities can meet your toughest delivery schedules ...your most exacting product specifications.

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4 **HYDRAULIC PUMPS**—High pressure, high speed fixed and variable displacement.

5 **ROTARY SHIMMY DAMPER**—For use on nose and tail wheels, outrigger gear, and helicopter landing gear

6 **FLUTTER DAMPER**—For all control surface vibration applications. May also be utilized as a combination damper-rotary actuator.

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8 **ROTARY ACTUATORS**—Direct rotary torque output without undesirable backlash inherent in linear systems. Available for any envelope requirements.

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10 **HYDRA SPRING**—A precision hydraulic device using compressibility of liquids to produce unusually efficient and highly effective spring and/or damping actions.

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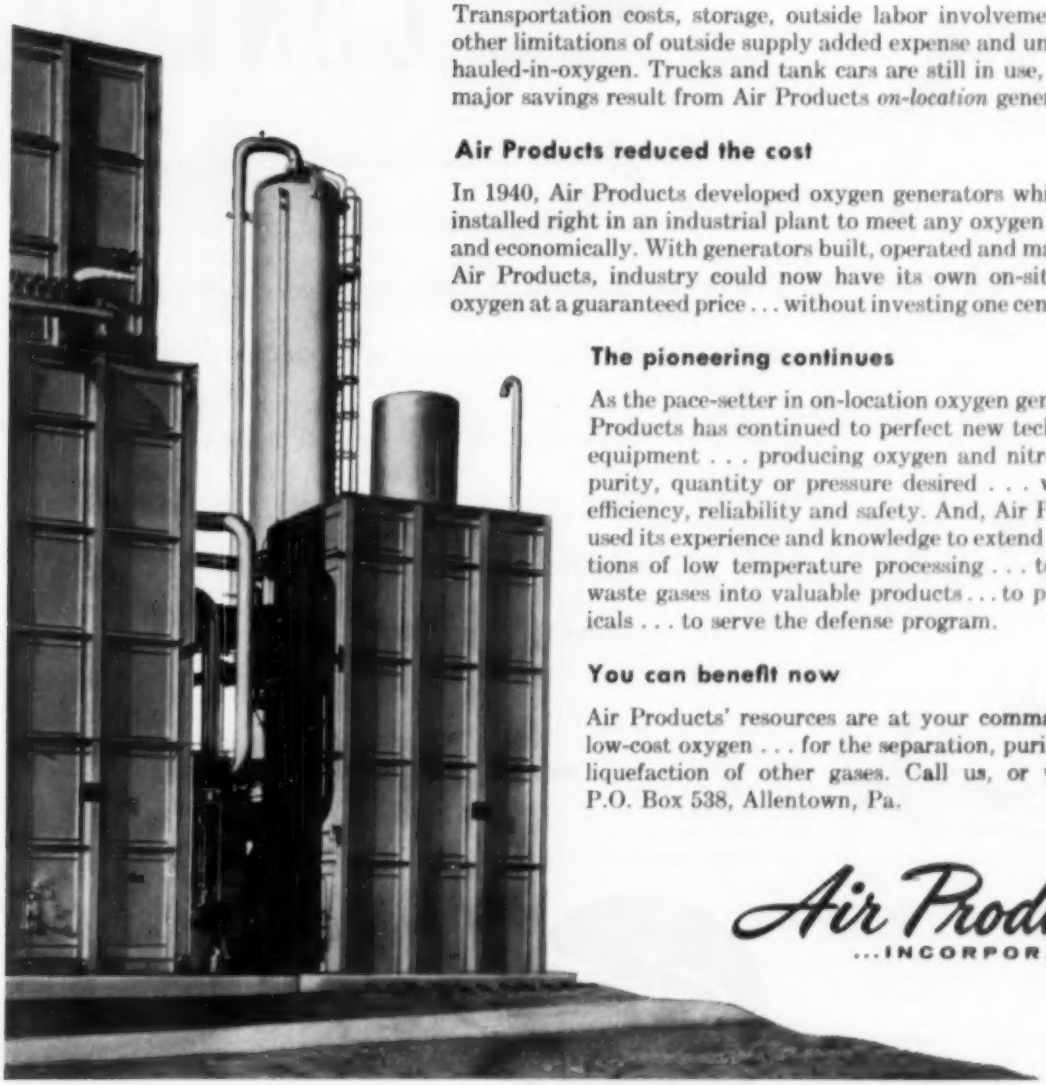

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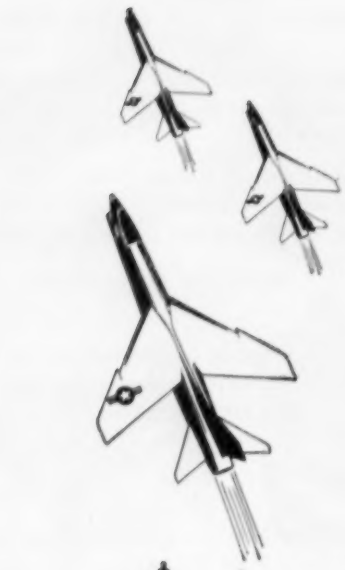

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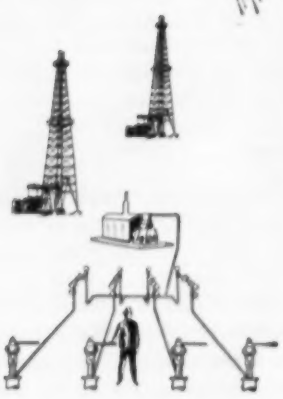
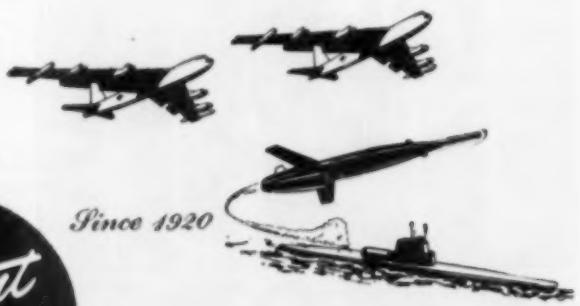


"GOOD WILL" is the disposition of the pleased customer to return to the place where he has been well treated.
– U.S. Supreme Court



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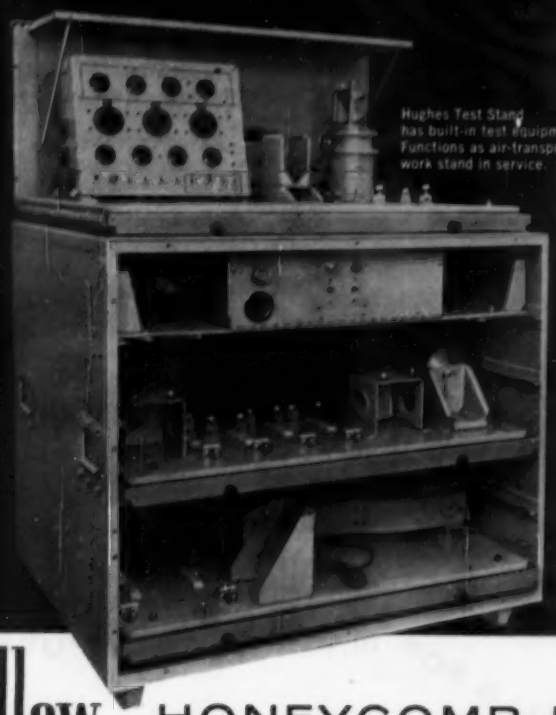

Hughes Test Stand has built-in test equipment. Functions as air-transportable work stand in service.

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provide **1. High Strength-Weight Ratio 2. High Rigidity-Weight Ratio 3. High Fatigue Resistance**

for HUGHES Test Stands

Front of Test Stand is removable. It may be attached, as shown, to rear of cabinet. Flip-out shelf is handy accessory feature during testing.

Hughes Aircraft Co. Test Stand is equipped with skids on bottom, and handles on sides for easy handling. Approximately 30" x 40", closed.

Sub-assemblies are mounted on racks, slide in and out.

Work surfaces are flat, rigid and insulated to protect against electrical shorting of circuits.

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Armament control systems, radar systems, computer program equipment, and other types of electronic systems are easily tested and quickly serviced by use of these unique, air-transportable honeycomb panel test stands produced by Swedlow Plastics Company to the specifications of Hughes Aircraft Company.

Sides, bottom, and top are of Swedlow aluminum honeycomb material between sheet aluminum faces. Each cabinet contains sub-assemblies and the test equipment necessary for checking out the particular portion of the electronic system it houses. These sub-assemblies are mounted on racks that slide into the cabinet, and are kept ready as spares for instant replacement in the operating system whenever required.

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September 16, 1957

AVIATION WEEK

Vol. 67, No. 11

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EDITORIAL

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COVER: Catapulted from deck of British carrier Ark Royal, Vickers Supermarine Scimitar picks up speed as bridle drops into ocean. Scimitar, the production version of the N.113, is a multi-purpose strike fighter for Royal Navy. Fixed armament is four 30-mm. cannon, and provision is made for carrying bombs, rockets and mines. Two Rolls-Royce Avon engines power Scimitar, and air is bled from them to blow over flaps for supercirculation, a lift device helpful in carrier operation. Other pictures of Scimitar deck trials on pages 70-71.

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69,686 copies of this issue printed
AVIATION WEEK • September 16, 1957 • Vol. 67, No. 11
Member of ABP and ABC

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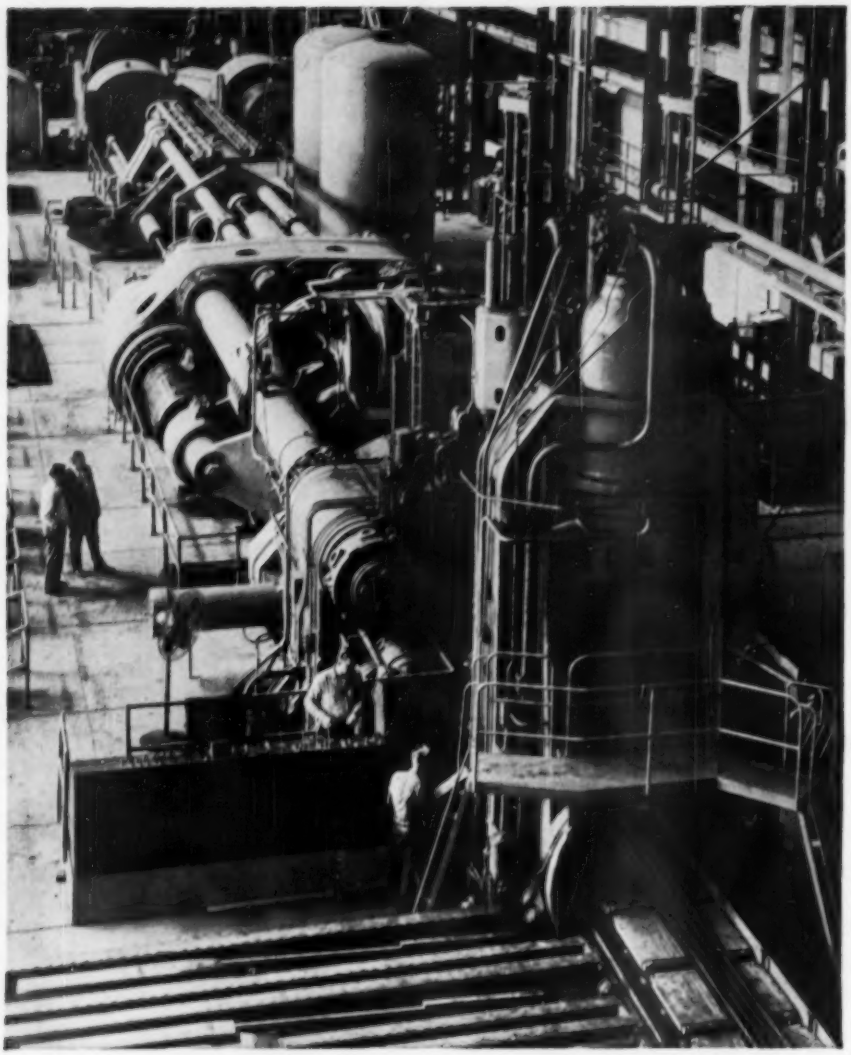
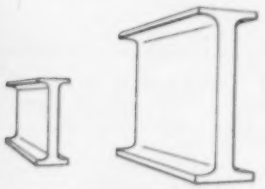
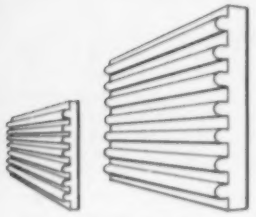


HOW THE 13,200-TON PRESS BOOSTS EXTRUSION CAPACITY



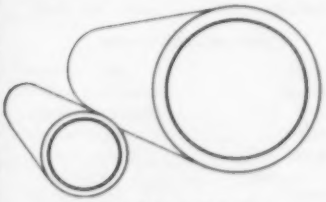
FROM 11" TO 28"

STRUCTURAL SHAPES



FROM 9" TO 20"

STIFFENED SECTIONS



FROM 10" TO 24" O. D.

TUBING

DOW'S NEW EXTRUSION PRESS PACKS 13,200-TON PUNCH

Here's a whole new range of large magnesium extrusions:
24-inch O. D. Tubing 28-inch I-Beams 80-foot-long sections

This mammoth press, newest addition to The Dow Chemical Company's rolling and extrusion mill at Madison, Illinois, is the world's largest magnesium extrusion facility. Its vastly increased capacities afford new opportunities for designers working with light metals. A wide variety of new magnesium applications for aircraft, missile, military and general industrial use are now possible and practical. In addition to extruding magnesium, the press is also available for large aluminum extrusions.

Here's how the big press will increase maximum dimensions of representative magnesium extrusions: Integrally stiffened sections, from 9 to 20 inches wide; I-Beams from 11 to 28 inches high; round tubing from 10 to 24 inches outside diameter; and maximum lengths of 80 feet. A large number of shapes and forms can be produced, limited only by the design of the die through which the metal is extruded. Many complex shapes that formerly required separate operations can now be formed in one operation.

If your design calls for large magnesium or aluminum extrusions, contact the nearest Dow Sales Office or write to THE DOW CHEMICAL COMPANY, Midland, Michigan, Department MA 1406A.

YOU CAN DEPEND ON DOW

EDITORIAL

The "Missile Industry" Myth

The United States Army is reaching a fever pitch in a vicious campaign of myth and half-truth to try to establish its dominance in the development and operational use of guided missiles.

Not since Admiral Radford led a salt-encrusted phalanx of admirals to Capitol Hill in 1949 on an abortive mission to discredit the use of atomic weapons and long range bombers has there been such a concerted campaign by one military service to advance its cause by blackening another service and the industry that serves it.

False Claims

The Army case is based on three completely false premises.

They are:

1. The guided missile, particularly in its ballistic form is simply a development of the bullet and artillery shell. Nothing could be more revealing about the technical naivete of the Army leaders than their advancement of this thesis. The missile in all its forms relies on the basic knowledge of aerodynamics, propulsion and guidance that has been developed and is still being developed by the aviation industry and its research agencies.

2. The Army, primarily through its former German technicians at Redstone Arsenal, pioneered ballistic missile development and currently has a virtual monopoly on technical knowhow and ability in this field. We will demolish this myth in detail in later editorials. Suffice to say here that the Army technicians are dependent on and regularly use research and development data fed to them by Navy, Air Force, National Advisory Committee for Aeronautics and major firms in the aviation industry.

3. The Army Ordnance arsenal concept of weapons development can make progress in perfecting technically sophisticated weapon systems such as missiles better than the combined efforts of the aviation industry, and a separate "missile industry" should be developed to produce arsenal-developed missiles.

Army Ordnance has a black record in new weapons development dating back to the Civil War, and its current performance in guns, tanks and missile development is equally uninspiring. This country applied the Army Ordnance concept of weapons development to aviation in the 1920's when government aircraft factories were operated and designs developed by one private contractor were given to other low bidders for production. Not until this policy was abandoned as a result of the Morrow Board investigation and the main burden of research, development and production shifted to the then infant aviation industry did our military aviation begin to rise out of the technical doldrums.

Other countries have tried the ordnance-type development philosophy with similar results. The pre-World War II French aircraft industry was nationalized and completely failed that country in its hour of crisis. The post-war British aircraft industry was plagued by a Socialist government that imposed government control to a degree that disastrously decelerated the once lively pace of the British aviation industry's technical development.

The concept of Army Ordnance-developed missiles farmed out for production to a satellite "missile industry" completely ignores the lessons of history and the facts of today.

There is in fact no separate "missile industry" or missile science nor is there likely to be in the future.

Missile development is a phase of aerial weapons development. As such it is an integral part of the aviation industry and its avionics and propulsion segments. Of the 34 current missile projects under development or in production for the Army, Navy and Air Force, 32 are under the prime cognizance of aviation industry firms. The two Army projects that have been farmed out from Redstone Arsenal to Chrysler Corp. for production use aviation industry propulsion and guidance systems.

Parallel Programs

Missile development today is based primarily on the research and development of the aviation industry, the National Advisory Committee for Aeronautics, and Air Force and Navy research agencies during the past 15 years. Development of unmanned missiles and manned supersonic and hypersonic aircraft are parallel programs of the same basic technology not separate and unrelated fields. As one distinguished U. S. scientist put it:

"Everything that flies through the air is subject to the same laws of aerodynamics. The air doesn't care whether the vehicle traveling through it is manned or unmanned."

The attempts of the Army to force its ordnance arsenal philosophy on missile development and the efforts of its pamphleteering henchmen to organize a National Missile Industry Conference (see p. 30) aimed at dragging missile business from the aviation industry into a separate "missile industry" are doomed to failure because they are flying in the face of technological facts.

—Robert Hotz

FIRE, OVER-HEAT DETECTORS NO FALSE-ALARMERS

Fenwal Units Detect Real Danger at Once

ASHLAND, MASS. — Every time a Fenwal Unit Fire and Over-Heat Detector gives an alarm, a temperature danger point has been reached that very instant. The unit will not, if properly installed, ground planes with false alarms.

A glance at the design of the Detectors will show why their response to temperature conditions is inevitably prompt and accurate. The stainless-steel shell of each Detector is the temperature-sensitive element. As it expands, it closes contacts hermetically sealed inside.

Shock and vibration cannot disturb the Detectors' accuracy. Neither can temperatures ranging from — 85° F to (for short periods) 2000° F.

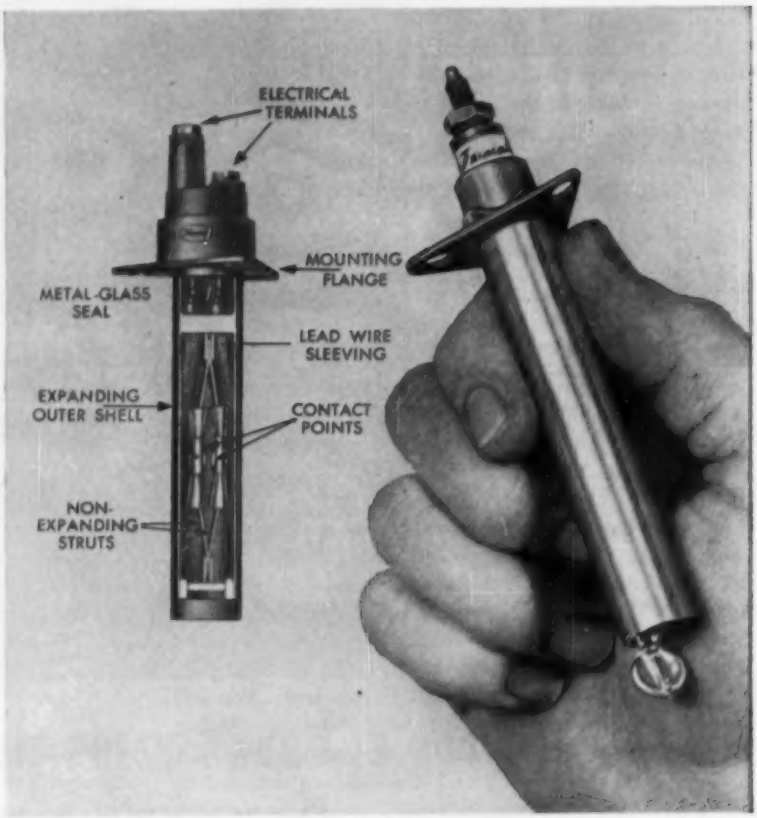
The alarm point is set at any point from 100° F to 1000° F, depending on the model. Some are factory set, others may be adjusted in the field. When temperatures drop below the alarm point, the units automatically reset themselves.

They are designed specifically for aircraft, are both light and compact. Roughly, they are slightly larger than a fountain pen, and the heaviest of them weighs only 3.25 ounces. They are generally equipped with a triangular mounting flange, calling for three holes in a 1.25-inch-diameter bolt circle.

Their current rating is 2 amps, 28 volts, D.C., and there is no need for external relays or costly field adjustment.

They may be had for either single- or double-wire circuits. Each Detector in a system operates independently. Double-terminal Detectors in a double-loop circuit eliminate all possibility of false alarms due to grounding and will operate even with a system fault. Faults in either type of circuit can be detected easily by means of a simple, push-button test.

Fenwal Unit Fire and Over-Heat Detectors meet exacting government specifications. Over many years and with hundreds of thousands of flight hours, they have been thoroughly proven by nearly every major aircraft user and manufacturer. For further details, write to **Fenwal Incorporated, Aviation Products Division, 126 Pleasant Street, Ashland, Mass.**



A TROUBLE-DETECTOR, NOT A TROUBLE-MAKER — You can depend on Fenwal Unit Fire and Over-Heat Detectors for aircraft the way you can depend on Monday's being followed by Tuesday. The reason for this dependability is made clear by the cross-section. The outer stainless-steel shell is the sensing element, and the simple moving parts are hermetically sealed inside.

Fenwal

CONTROLS TEMPERATURE ... *PRECISELY*

WHO'S WHERE

In the Front Office

Jack S. Parker, vice president-public relations and employe relations, General Electric Co., succeeding Lemuel R. Boulware. Mr. Parker was vice president and general manager, GE's Aircraft Gas Turbine Division.

Robert K. Stern, president, Mid-Century Instrumatic Corp., New York, N. Y.

C. Hart Miller, executive vice president, general manager and a director, The Sierracin Corp., Burbank, Calif.

Robert A. Hall, a vice president and a director PacAero Engineering Corp. (Santa Monica), subsidiary of Pacific Airmotive Corp., Burbank, Calif.

Dr. William F. Ballhaus, a vice president of Northrop Aircraft, Inc., and general manager of the newly established Nortronics Division, Beverly Hills, Calif. **George Douglas** succeeds Dr. Ballhaus as vice president-engineering, Northrop Division. Also: **Roy P. Jackson**, chief engineer, Northrop Division.

Roy E. Wendahl, vice president-sales, Hughes Aircraft Co., Culver City, Calif.

E. E. Brush, vice president-engineering, and **Wesley L. Peckham**, vice president-Aerosmith Products, L. B. Smith Aircraft Corp., Miami, Fla.

J. Vance Holdam, Jr., vice president-operations, Laboratory for Electronics, Inc., Boston, Mass.

Morton D. Weiner, vice president A.S.R. Products (New York), and chief operating officer of the recently acquired Com-Air Products Division, Los Angeles, Calif. Also: **Thomas J. Sheehan**, manager-operations, Com-Air Products.

Earl G. LeBeau, vice president, Universal Unlimited, Inc., Glen Cove, N. Y.

Rear Adm. Robert M. Reynolds, Assistant Chief of BuAer for Field Activities, and **Capt. Paul J. Burr**, Director of Maintenance Division, Department of the Navy, Bureau of Aeronautics, Washington, D. C.

Ralph L. Clark, manager-Washington, D. C. office, Stanford Research Institute, Menlo Park, Calif. Mr. Clark succeeds **George T. Hayes**, now assistant director of SRI's physical sciences research division.

Maj. Gen. R. W. Puryear, Chief of Staff, Headquarters Air Defense Command, Colorado Springs, Colo.

Gordon Banerian, manager, Turbo-Machinery Division, Aerojet-General Corp., Azusa, Calif., appointed to company's Titan Technical Advisory Committee.

Col. Frank G. Jamison has assumed command of Eglin AFB, Fla.

Honors and Elections

Annual recognition of outstanding work in helicopter development will be provided by the **Grover E. Bell Award**, created in the will of the late Lawrence D. Bell, founder of Bell Aircraft Corp., in memory of Mr. Bell's brother who was a pioneer aviator.

Charles B. Thornton, board chairman and president of Litton Industries, Inc., has been awarded an honorary Doctor of Laws degree by Texas Technological College.

(*Continued on page 153*)

INDUSTRY OBSERVER

►**USAF's nuclear-powered aircraft project—WS-125A—will be cut to a $150 million level of activity for Fiscal 1958. This includes both Lockheed and Convair in airframe development and General Electric for the powerplant. Rate of technical progress at this fiscal level is doomed to be slow.**

►Allison expects to static test its 25,000 lb. dry thrust J89 turbojet engine before USAF funds are cut off at the end of this year. The J89 is a 12-to-1 pressure ratio twin-spool engine which by-passes flow around the high-pressure compressor at flight speeds over Mach 2. There is no airframe for the J89, since USAF now wants a single-spool engine for the WS-110A, but Allison plans to maintain the powerplant as a shelf item in hopes that a future need will materialize. Allison's best new engine prospect is now its 5,000-hp.-plus twin-spool turboprop, the 550, for which a USAF development contract was received last week.

►**Navy is shifting to land-based aircraft for its anti-submarine patrol mission. Despite a tentative nod to Convair for development of a water-based, tri-motored design for ASW work, no formal contract has been tendered for the project. Navy is now organizing a design competition for a land-based ASW patrol plane. Lockheed plans to submit a military version of its turboprop-powered Electra in the new Navy competition.**

►Bell XV-3 convertiplane will be returned to the wind tunnel for further testing sometime this month. Convertiplane has not yet made the transition from vertical to horizontal flight because of vibration problems.

►**Half a dozen firms now have sidelooking radar systems (AW June 3, p. 180) in limited production or development. At least one system (AW Aug. 12, p. 29) records radar picture on continuous strip photograph. Sidelooking radar maps terrain from each side of vehicle carrying it. System can cover broad area, pick out fine detail, while flying at relatively low altitudes.**

►Gen. Thomas Power, chief of the Strategic Air Command, had what was probably the longest supersonic flight of any senior USAF general when he flew more than 30 minutes above Mach 1 in the Convair B-58 (AW Sept. 9, p. 39). Maximum speed reached during the flight was Mach 2.09 at an altitude of 50,000 ft.

►**Model of Hiller X-18 tilt-wing VTOL has completed tethered flight tests in the full-scale wind tunnel at NACA's Langley Aeronautical Laboratory, Langley Field, Va.**

►Omega long-range navigation system will be among those offered for discussion by the U.S. delegation to the Communications Division meeting of the International Civil Aviation Organization now under way in Montreal. Resembling the British Delrac system, Omega is an outgrowth of Navy's Radux. It is continuous wave, phase comparison system operating in the 10-14 kc. band and is used with a dead reckoning computer such as Librascope AN/ASN-9.

►**Army's three-ton cargo helicopter design competition will be carried out sometime late in this fiscal year. Marines also may join in the project.**

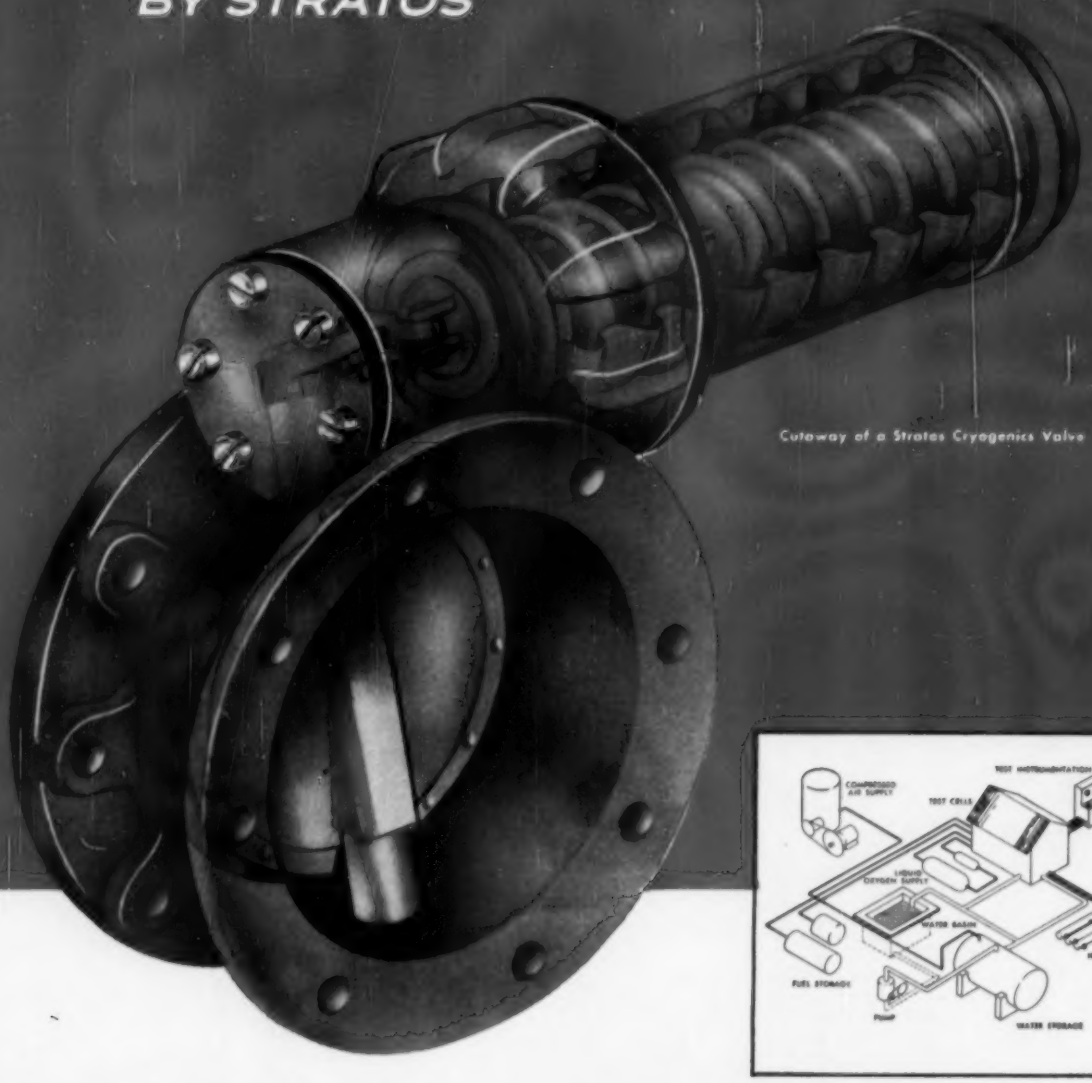
►Vertol's tilt-wing VTOL is scheduled to make its first transition flight within the near future. First vertical free flight was recently made from Philadelphia's Municipal Airport.

►**New version of the single-engine Navion developed by Navion Division of the Tesco Corp. in Galveston, Tex., is nearing completion of its CAA certification program. Aircraft employs tip tanks and 240-hp. Continental.**

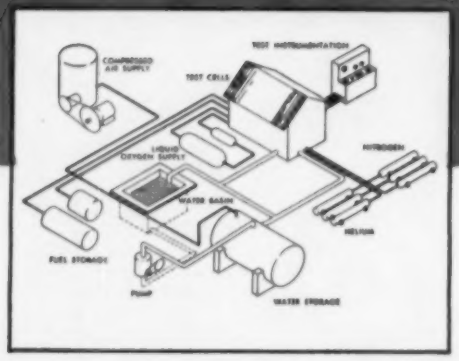
►Lockheed, ACF Industries, Kaiser Engineering and Phillips Petroleum are joining to explore the economic feasibility of private investment in a nuclear research center. Study group is headed by R. M. Jones of ACF Industries.

CRYOGENICS VALVES AND PUMPS

BY STRATOS



Cutaway of a Stratos Cryogenics Valve



Schematic of the new Cryogenics Test Facility at Stratos Western Branch

With the facilities and experience to meet the growing requirements of cryogenics, Stratos is at work on a number of interesting projects in the low temperature field. Besides a basic background in the aircraft accessories field, Stratos engineering department includes specialists in cryogenics—men who have broad experience with gases at very low temperatures and with liquefied gases.

Among the cryogenic facilities at Stratos is a test installation recently completed at the Western Branch plant Manhattan Beach, Calif. This facility can test valves up to 12" diameter and achieve flow rates above 11,000 gpm.

Inquiries on valves, pumps, controls and systems are invited.

STRATOS

A DIVISION OF FAIRCHILD ENGINE AND AIRPLANE CORPORATION

Main Plant: Bay Shore, Long Island; N. Y.
Western Branch: 1800 Rosecrans Ave.,
Manhattan Beach, California.

Washington Roundup

Contract Cuts

USAF is dropping hints that further contract cuts will become imperative in order to complete the "big jump" concept in development. Lt. Gen. Clarence S. Irvine, deputy chief of staff, materiel, says Mach 3 is the next milestone in speed and that Air Force headquarters is determined it will be achieved. "Probably," he says, "at the expense of programs that currently appear to offer Mach 2 or less." New manned weapon systems also must have high performance capability from tree-top levels to 75,000 ft.

Staying within the $7 billion a year allowance for procurement and about $600 million for development, Gen. Irvine says, will force USAF to get tougher about over-runs. High cost will be considered as prima facie evidence of poor management and "so some old familiar faces may be missing."

Gen. Irvine is convinced that Russia is working below capacity and that the Soviets have a determination to beat the U.S. at its own game—industrial output.

Missile Marriage

Hottest and most secret meeting at the Pentagon last week was the running session of the Defense Department's three-man missile committee. USAF's Maj. Gen. Bernard A. Schriever, Army's Maj. Gen. John B. Medaris and William M. Holaday, special assistant to the Secretary of Defense for guided missiles, spent several days trying to resolve the IRBM problem. It is generally accepted that they will come out with some kind of a marriage between USAF's Douglas-built Thor and Army's Jupiter from the Redstone Arsenal.

While Army partisans have expressed the opinion that Jupiter—to be built by Chrysler—can be in production in one to four months, Defense Secretary Charles E. Wilson is more conservative. He says it will take at least 18 months to get an IRBM on a production basis and then only because "you can do astonishing things in a year if you want to." Merger of the Thor and Jupiter, the Secretary said, will not cause any serious delay. The Secretary showed additional insight into the current missile problem with the observation that the big problem is to get a consistent weapon, "not just something you can shoot once."

Homeless IRBM

Serious and expensive problem of providing launching sites for ballistic missiles was pointed out sharply by Secretary Wilson in conversation with reporters last week. Asked if there is any chance that Strategic Air Command will have an intermediate range ballistic missile within a year, Wilson snapped back: "I don't know where they'd set 'em up if they had 'em in a year."

General Confusion

Pentagon security is still under siege from House Government Information Subcommittee guns, which now include Civil War artillery.

Editor of Armor magazine, an unofficial publication, submitted Lt. Gen. Ulysses S. Grant III's review of a book by a Confederate Civil War general to the Pentagon for security review. The editor said he was submitting the book for review because it "is critical of the reconstruction period, which in return is critical of our government," and because he "deemed it advisable to protect both the reviewer and myself by having it sent through Security Review."

Pentagon cleared the book. But it denied the subcommittee's request to see the files on that case and 32 others.

Assistant Secretary for Public Affairs Murray Snyder cited "separation of powers between the three great branches of the government" as the reason, and harked all the way back to the presidency of another general—Washington—to establish precedent. Subcommittee chairman John E. Moss (D.-Calif.) said all this "would be laughable if it were not part of such a serious problem," and asked once more for a look at the files.

More Missile Misinformation

Eisenhower administration continues to follow a skeptical line about the importance of Russia's announcement that it has successfully fired "a super-long-distance intercontinental multi-stage ballistic rocket." Deputy Defense Secretary Donald A. Quarles said in a speech last week that phrasing of the statement "is the way we would describe a first experimental test, not necessarily even a prototype of a fully developed weapon. In our experience, it is a far cry from this to an operational system." Reports of firings of Russian ICBM's date back almost four months (AW May 20, p. 26). Quarles also said, "We have for some time credited the Soviets with substantial progress in the long range ballistic missile field" and "we still do not expect to be beaten in this ballistic missile race."

Keep 'In Charge of Future'

Defense Science Board will start a new and presumably happy relationship with the Pentagon this week when it holds its first meeting with Dr. Paul D. Foote. Foote, sworn in last week as Assistant Secretary of Defense for Research and Engineering, says he plans a quarterly session with the board now headed by Dr. Howard P. Robertson of the California Institute of Technology.

Last real session of the Board was on April 4, when the members exploded over the attitude of Foote's predecessor, Frank D. Newbury, who made it clear he would make all the decisions (AW April 15, p. 26). Foote, in contrast, says he will depend upon the board, composed of 20 top U.S. scientists, "to keep us on the ball." Foote, 69-year-old research physicist and engineer, has a recess appointment pending Congressional action on his choice. His life savings are in oil stock and he does not want to dispose of it, although he is willing to sell some other securities in order to meet the conflict of interest regulations. He says he now looks upon himself as "vice president in charge of the future," a definition that should please the Board.

Atlantic Charters

Supplemental air carriers and certificated cargo carriers transported 9,700 persons on entity charters and 9,900 persons on roundtrip pro rata charters across the Atlantic between Jan. 1 and September. Civil Aeronautics Board says there were 132 one-way entity charter flights and 109 roundtrip pro rata charter flights by 10 of the carriers. Most flights were chartered by employe clubs, student groups and social organizations on vacations.

—Washington staff

Air Force To Cut R&D Expenditures 8%

Economy drive may mean reshuffling, curtailment or elimination of some of ARDC's facilities.

By Claude Witze

Washington—USAF's research and development program is being realigned to cut expenditure rates by 8% during this fiscal year.

There is a possibility that Air Research and Development Command facilities will be reshuffled and that some of them will be merged, curtailed or eliminated. Others may have their mission altered.

The economy drive is not an arbitrary across-the-board order that will take a bite out of every project, regardless of its relative importance to the defense effort. It does mean that the complete program must be cut to stay within a research and development ceiling, imposing a new mode of management that will be in full swing for Fiscal 1959.

ARDC Realignment?

Richard E. Horner, Assistant USAF Secretary for Research and Development, told AVIATION WEEK that the entire structure of ARDC is under scrutiny. Although it is too early to speculate on what change will be made, he anticipates that the new setup will be finalized before January 1.

Present organization of ARDC was established in 1951. It includes 10 R&D centers scattered from Cambridge, Mass., to Cocoa Beach, Fla., and Edwards, Calif. In addition to the centers and ARDC headquarters in Baltimore, USAF's research and development appropriation supports the Arctic Aeromedical Laboratory in Alaska, the School of Aviation Medicine in Texas and the Air Force Proving Ground Command in Florida.

Also separated from headquarters and not designated as centers are the Office of Scientific Research in Washington, the Armed Services Technical Information Agency at Dayton and the Air Force Ballistic Missile Division, formerly Western Development Division.

Facilities Review

Overall, Secretary Horner feels that the Defense Department ceiling on R&D expenditures necessitates a complete review of facilities. The question, he told AVIATION WEEK, is to determine whether or not USAF needs a 1951 structure to perform the tasks of 1957 and the years following.

Horner pointed out that funds for operation and management of ARDC facilities are included in the research and development budget and constitute a substantial part of the total.

For Fiscal 1958, for example, nearly half of the total R&D program is for operations and management, which includes the housekeeping costs of the ARDC center and other installations. In this year's budget, operations and management totals $323 million out of the total $661 million.

It has been pointed out by Maj. Gen. R. P. Swofford, Jr., director of research and development for the Deputy Chief of Staff, Development, that only part of the workload on ARDC facilities comes from the R&D program itself. A large share of the burden comes from the production program and engineering support of USAF's combat wings.

There are two other complications. The first is that the current testing load on the centers was determined for the most part by what was spent for R&D, production and modifications in recent years.

Facilities Demand

Second, and possibly most critical in view of the technological race with Soviet Russia, is the constant demand for new test facilities. In the past five years, an average of $90 million in new construction has been authorized each year. In those five years, there have been large extensions in the state of the art, while the emphasis has shifted to new types of technical problems. The ballistic missile effort is only one part of this picture.

In addition to captive missile test devices, the demand for new equipment runs to other expensive items such as solar furnaces, high energy fuel equipment, nuclear material test reactors and hypersonic test facilities.

Defense Department financing policies have increased the amount of money in the total research and development account (Series 600), but they also have shifted to this account the matter of providing for maintenance and housekeeping. The pace of technological advance since 1951 has turned the budget policy into a handicap for ARDC and is one of the reasons why the aircraft industry has been urged to invest more of its own money in the R&D effort.

So far as industry research and development contracts are concerned, Horner says the bulk of the cancellations have been disclosed. Such projects as the North American Navaho missile and Republic's F-103 are typical of the cutbacks that will result in R&D economics. There will be other cancellations, Horner says, but not on major programs.

As indicated earlier (AW Aug. 19 p. 34), the aircraft nuclear propulsion program remains under constant study and appears to be one that faces definite delay. Pratt & Whitney Division of United Aircraft Corp., already has told its stockholders that the project faces curtailment or delay so far as USAF is concerned.

Nuclear Problems

Horner says the ANP program, of all those in the R&D stable, is the one most seriously impeded by technical difficulties when they appear. Inevitably, trouble develops and the projected date for the next step in the program is postponed.

In testimony earlier this year before the House Appropriations Subcommittee, Horner said the propulsion elements of the ANP program "are proceeding at a healthy rate" but that only limited work is being done in the airframe area.

He also said USAF has retrenched in its work on radiation effects, which is important to the development of materials, components and subsystems. As a result, almost all attention to components and subsystems has been dropped.

Last week, he indicated to AVIATION WEEK that the entire ANP project tends to be tempered each time a new difficulty appears and the application is postponed. One major reason for this appears to be that the nuclear-powered airplane will have the single advantage of range limited only by the endurance of the crew.

Funding Level

It is USAF's view that the level of funding for the ANP project must be keyed to the progress being made on the next best means of improved propulsion, which probably is the chemical bomber. One top general has said the "big question" is "how the performance. . . . compares with the best you can do with other things."

Horner says the chemically-powered aircraft can be produced quicker than its ANP counterpart. On top of this, it is known that USAF operations experts are seriously concerned about the new problems in logistics and training that will be involved if nuclear propulsion is introduced into the combat system. USAF has consistently rebuffed suggestions, usually from congressmen, that the chemical bomber be dropped and all the effort—and money—be concentrated on nuclear propulsion.

USAF Research Program in Danger

Washington—Entire structure of Air Force advanced research program is in danger of collapse because of budgetary moves now being made as a result of the Eisenhower Administration's hold-down on defense spending, Aviation Week has learned.

The situation at that time was that the Air Research and Development Command was considering severe curtailment or cancellation of well over half its 3,000 contracts with industrial and scientific organizations.

Air Force Office of Scientific Research projects that will go first include Aeronutronics, Inc.'s Project Far Side, in which the company has invested $400,000; support of Litton Industries' important high vacuum chamber, in which man has reached a simulated altitude of 90 miles. This is another project which the company at present is paying for itself because of lack of AFOSR money.

Some contractors already have warned they will do no more research for the Air Force after present contracts end because of continued uncertainties.

Importance of the work being done was given virtually no consideration. Determining factor on what will be killed is dollar cost.

Greatest threat appears to be in the area of advanced research—work intended to build the future Air Force. Years of effort the Air Force has put into developing the concept and building structure to do this vital type of research may be sacrificed completely to budgetary considerations.

AFOSR at the beginning of last week was planning in terms of cancelling 50% of its contracts. But development by the end of last week made it appear that AFOSR has no alternative but to go out of business.

Funds available will pay only bills for past work—which means all contracts will be killed and no new ones let under present planning.

Effect of this, unless some relief is found, would be to end Air Force's chances of buying effective research from the scientific community, and severely cripple its standing as a customer for industrial research work.

Industrial contractors might be more likely to return if budgets are increased in some future year. But hard-won confidence and cooperation of the scientific community would be irreparably damaged.

Indignation already has been expressed by some contractors as a result of the policy which calls for putting dollar costs ahead of importance of work.

One major mid-western university contractor already has told AFOSR it is through as an Air Force contractor and another apparently had come to that conclusion by end of last week. AFOSR already has let go some researchers and administrative personnel and dropped the applications of other researchers who were being considered for hiring.

Irony is that AFOSR's budget is only $16 million of the $600 million plus that ARDC receives directly for research and development, and the office's overhead is only 3% of the $16 million—probably as low as that of any agency in government. Of this, 97% of its budget bought research.

Another irony is that Congress approved the entire $16 million budget—although AFOSR was not allowed to ask for funds for new research—but the result of administration policy is that AFOSR now can spend only half of that—and $8 million will only pay for work already done under earlier contracts.

Degree to which 10 other ARDC centers will be affected is not known in detail. But entire ARDC structure now is being reviewed with great care, solely due to budgetary problems (see page 26).

Some of the most important AFOSR contractors already are carrying projects on their own funds, hoping to be reimbursed at a later date. If present planning is carried through, support of Rand Corp. by ARDC centers probably will be cancelled.

Stainless Developed For Mach 2.5-4 Use

Precipitation hardening stainless steel, claimed to be, on the whole, superior to titanium alloys for 500-1,000F applications has been developed by Armco Steel Corp., Middletown, Ohio. It is scheduled for use in an airplane now in design stage.

Armco said the new steel, PH 15-7 Mo, (precipitation hardening, 15% chromium, 7% nickel, plus 2.5% molybdenum) is equal to or superior to the best titanium alloys on a weight-to-weight basis and vastly superior in workability and cost. It is a successor to Armco's present 17-7 PH precipitation hardening stainless steel used on high speed aircraft.

Pointing out that almost three-fourths of the weight of many airframes is made up of flat-rolled sheet metal, Armco predicted that in 5-10 years the advent of the Mach 2½-4 aircraft will consume $200 million worth of PH 15-7 Mo type stainless steel annually.

So far only several hundred tons of the new material have been produced, but Armco expects to spend over $70 million in its current program to equip its Butler, Pa., works to produce sheet, strip, soil, plate, bar, wire, forgings and extrusions. Armco is planning to license PH 15-7 Mo to other companies.

PH 15-7 Mo is fabricated by the usual cold working shop practices in the soft condition and then heat treated with conventional equipment for high strength. In cost the new material is $2 per pound as against $20 per pound for titanium, Armco said.

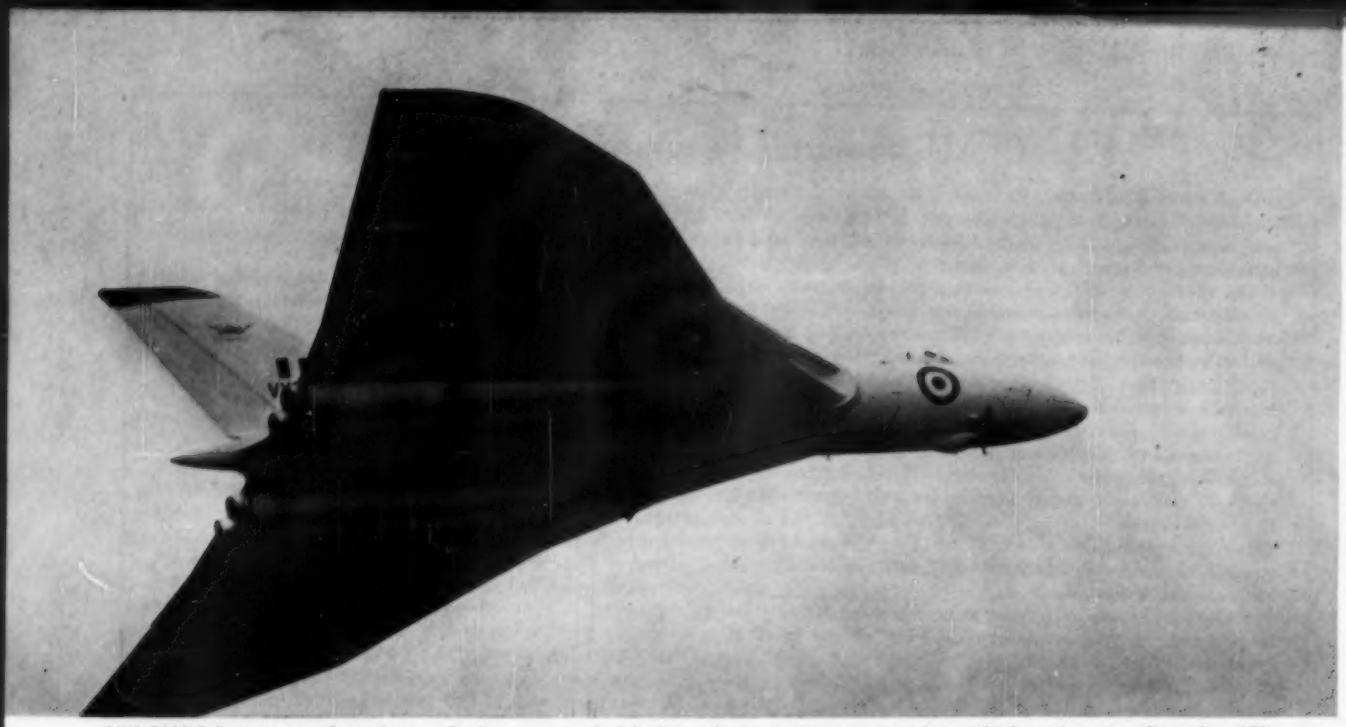
'Partial Truths'

Washington—Sen. Stuart Symington (D., Mo.), first Secretary of the Air Force, charged the Eisenhower Administration last week with telling the American people—including U. S. senators—only "partial truths" about Russia's intercontinental ballistic missile progress.

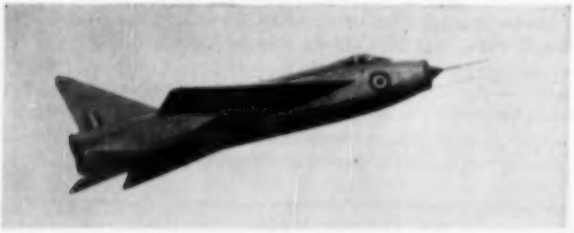
Sen. Symington said that when he first saw press reports of a Soviet ICBM firing (AW May 20, p. 26), he called the Defense Department as a member of the Senate Armed Services Committee and was told flatly that "there have been no ICBM tests in Russia."

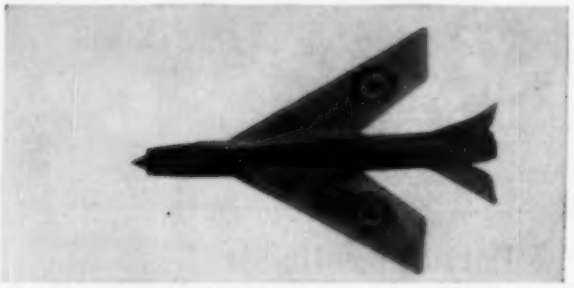
After the official Soviet announcement of a successful firing (AW Sept. 2, p. 27), Symington said he again called the Defense Department and was told, "We have known about this for quite some time."

In a press conference late last week, Sen. Symington also charged the administration with continuing a policy of "unilateral disarmament" despite the Soviet ICBM threat. The present defense budget, Symington said, is sufficient to provide the U. S. with an adequate defense, rather than "unilateral disarmament," if it is administered correctly. The problem, he added, is that the Defense Department is now geared to fight World War II rather than World War III. The Defense spending cuts, he said, have now extended to the U. S. ICBM program despite "misinformed" statements by the President to the contrary.

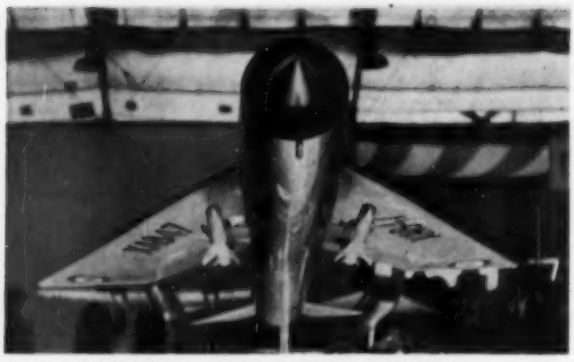


VULCAN B.2 prototype shows increased wing area, cranked leading edge, curved wing tips and sweptback section of trailing edge. Wing also has washout and three different dihedral angles.



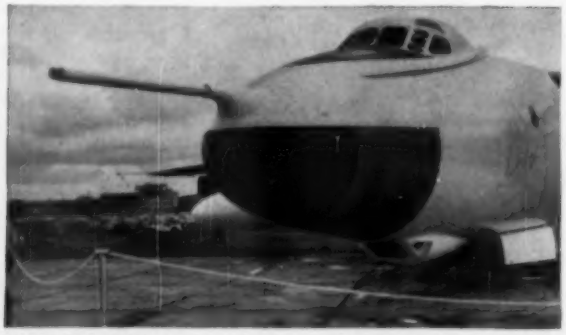


Modifications on Aircraft Displayed at Farnborough



ENGLISH ELECTRIC P.1B nose spike generates bow shock for supersonic inlet. Model shows possible Firestreak installation.

BLUNT trailing edges, vortex generators, are aerodynamic fixes on Gloster Javelin. They reduce drag, improve control.



EXTERNAL LINE along cockpit connects refueling probe of Valiant B. Mk.1 to fuel tanks.

SEA ViXEN, development of de Havilland 110, is just now replacing Royal Navy Sea Venom fighters. All-weather Vixen is armed with cannon and Firestreak missiles.

FAIREY DELTA 2, droops its nose on landing. Vividly painted experimental aircraft holds official speed record.

MILES STUDENT (below) surprised observers with speed and maneuverability—and price tag of under $40,000 in quantity.

Anonymous Prospectus Proposes New Missile Group for Industry

Washington—An anonymous group is circulating a prospectus proposing organization of a National Missile Industry Conference and seeking an initial contribution of $200,000 to establish a staff and offices in this city.

The prospectus denies any intention on the part of the promoters to compete with existing organizations and seeks support from all companies that consider themselves part of the rocket and missile industry.

Aircraft Industries Assn. and the Electronic Industries Assn., which include almost all missile prime contractors and a substantial part of the supporting manufacturers, told AVIATION WEEK that none of their members have been approached by NMIC promoters. Queries to about 25 missile prime contractors and component makers here and on the West Coast disclosed that none of them had ever heard of the organization.

The prospectus, which is unsigned and unaddressed, charges that there is confusion in both government and industry over "rockets, missiles and space flight." It says the major objective of NMIC will be to eliminate this confusion, entirely in the interest of "vital national welfare and progress." There is no intention, the prospectus says, of promoting any private interest.

Another professed purpose of NMIC is to provide a central source of information about the missile industry for the use of Congress, government agencies and the press. NMIC plans include a newsletter, an annual meeting and exhibit, symposiums and contractor services. In addition, it plans an elaborate publicity effort.

In addition to AIA and the electronics organization, there are two professional groups active at present in the field contemplated for NMIC activity. They are the American Rocket Society and the Institute of the Aeronautical Sciences. Both of these established organizations provide for publication of scientific papers, general dissemination of information and forums for discussion of rocket, missile and space flight problems.

Although the prospectus gives no name and address for the promoters, it says first year dues have been set arbitrarily at $2,000 per member. With a first year budget of $200,000, this indicates the organizers hope to find at least 100 charter members.

The members, it is suggested, can select a policy committee of 20 persons to guide the permanent staff. Actual management of operations, the prospectus says, will be contracted to a commercial firm.

There also was an attempt to organize a "Guided Missiles Institute" here in 1953. About 35 representatives of aircraft and electronics manufacturers attended one meeting, at which the organizers asked for the same $200,000 fund now sought for NMIC.

The Guided Missiles Institute did have an office in Washington for a few weeks, and its promoters made no secret of their identity. However, the effort died quickly when it failed to arouse interest and financial support.

There were reports that the NMIC has held a meeting, but, if true, those in attendance have not disclosed the fact. This rumor led to a report in one newspaper column that the NMIC is a "secret" organization dedicated to a campaign against cuts in military missile appropriations. AVIATION WEEK could find no substantiation for this interpretation.

Nuclear Engine Test

Washington—Contracts for construction of a facility for testing nuclear engines in conjunction with airframes, typical crew compartments and aircraft control systems at National Reactor Testing Station, Idaho Falls, Idaho, have been awarded by Atomic Energy Commission.

Flight Engine Test Facility will be located in Aircraft Nuclear Propulsion area of NRTS. Construction is to begin within 10 days and will take two years to complete. Contractors are Howard S. Wright Construction Co. of Seattle, Wash.; S. Birch & Sons Construction Co. of Great Falls and D. L. Cheney of Seattle. Contract total for the joint venture is $6,044,695.

Temco Drone Flies

First flight of Temco Aircraft Corporation's rocket-powered XKDT-1 target drone has been made at Naval Air Missile Test Center, Point Mugu, Calif. Drone flew nearly eight minutes after it was launched from an F3H-2M. Temco's XKDT-1 is designed to operate close to the speed of sound at altitudes up to 50,000 ft. First successful flight was launched at XKDT-1 uses solid-propellant fuel. The drone emits flares during the powered phase of its 20,000 ft. The drone is about 12 ft. long, 10 in. in diameter and has wingspan of 58.8 in. flight to make visual tracking possible. Air-to-air missiles trigger a hit indication when they come within a specified distance of the drone, leaving the target vehicle intact.

NACA Asks License For Research Reactor

National Advisory Committee for Aeronautics applied to the Atomic Energy Commission for a license to build a $10,735,000 research reactor. AEC will hold public hearings concerning the application beginning Oct. 8.

The research reactor will be used to develop other reactors suitable for aircraft propulsion, including loop studies of fuel elements and other components, radiation effect studies, shielding studies, and nuclear and solid state experiments. It will consist of a reactor pressure tank core shielded by concrete and water in a circular pool. The maximum thermal power of the reactor will be 60,000 kw.

British Missile Sales Barriers Loom

By David A. Anderton

Farnborough—Current British drive to export guided missiles systems to friendly countries has three major hurdles to clear: customer education in the systems concept, acceptance of high initial cost, and development of production capacity to cope with more than one order at a time.

While the systems approach is understood here—although it differs in details of application from the U.S. version—there are strong indications that some prospective customers lack the technical maturity to purchase properly this new generation of unmanned fighters.

The missile exhibition at Farnborough concentrated on the flying articles themselves and almost ignored the associated welter of equipment, tending to further the impression that missiles were simply small pilotless airplanes to be bought as some oil-soaked kingdom might buy a squadron of Hunters.

Early fostering of the missile as a cheap and expendable weapon, a view largely held for its political impact rather than its technical truth, has long since conditioned many observers of missile development to expect low costs. Such is not the case, because initial cost of an even small area-defense system is very large. "We look on this as similar to selling an Air Force," said one sales manager, "and we sell a complete package with vehicles, training courses, simulators and the works."

Even if such sales were made, there is reason to doubt that even the larger manufacturers would be able to cope with orders for complete defense systems for two or three countries at once. Production quantities of a typical anti-aircraft missile required to fill the logistics pipeline for the defense of a small European country are large for the initial installation. In the event of war, it would be highly unlikely that the pipeline could be filled at all, and the country's air defense would be reduced to a one-shot system.

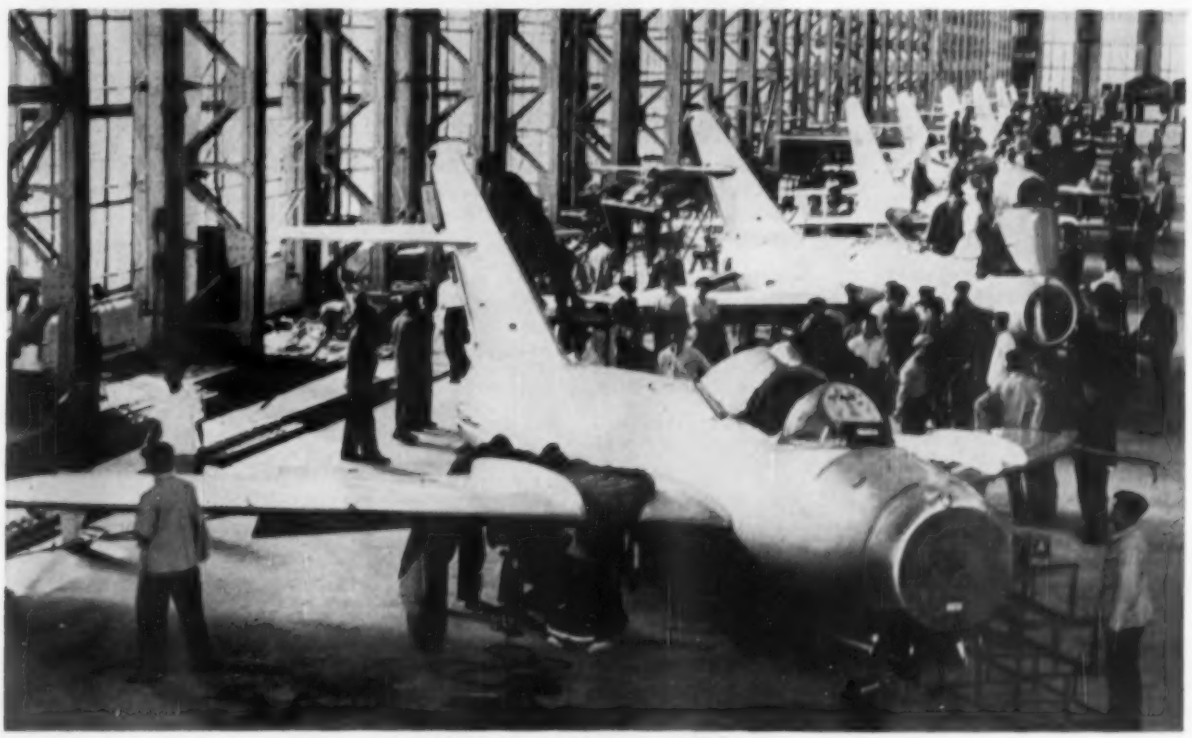
The number of Nike rounds manufactured in the United States is in the thousands. More than 1,500 test rounds alone were fired before the missile became operational. This effort was required simply to supply enough weapons to defend about one dozen selected target areas.

In Britain, a typical missile program has test rounds numbering in the hundreds. There are as yet no missile sites operational in the United Kingdom, and their supplies would certainly get first call on capacity. How many neighbors could be supplied is problematical.

Scale of the British production capacity is always hard to assess. Many of the factories still proudly refer back to their wartime records of thousands of fighters and bombers produced each year. They tend to forget that those airplanes were built by methods that are too crude to use today, and they assume that having done it once, they could do it again. This is not the case. Most informed British engineers agree that the production know-how of the aircraft industry is at a low level comparatively. There are reasons: the low percentage of technically-trained people in tooling and production jobs is one, and a tax structure with 20 year amortization of machinery is another.

What then can the British sell, and to whom can they sell it?

Current restrictions on customers limit them to Western European NATO countries and Sweden, but the list may be extended shortly to include the Baghdad Pact nations. To these countries a British missile maker is to be allowed to sell complete defense systems such as the Bristol Bloodhound



MIGs Line Chinese Factory

MiG-15 fighters line one wall of a Red Chinese factory. Buildings described as an assembly shop implying that production or major overhaul is taking place. Photo appears to have been taken at the end of a shift, for most of the tidy workers have turned in their tools, cleaned up their area and are waiting for the whistle.

or the English Electric Thunderbird.

"The customer must come to us with a genuine interest before we can talk to him," commented one technician. "He's got to tell us what he wants to defend, where it's located and what he believes is the threat. Then we put our people on it and come back with a proposal. We tell him what its going to cost and quote delivery schedules."

At least three European countries are now actively engaged in talks with British missile manufacturers aimed at establishing a common meeting ground on which to talk over the problems and conditions of missile sales.

Discounting test vehicles, development missiles, training missiles and the like, there is actually no missile in Britain today that could be classed as an operational weapon. These are four that are near that stage :

• **De Havilland Firestreak,** an air-to-air infrared homing missile standardized by both the Royal Navy and Royal Air Force for all-weather fighters.

• **Armstrong Whitworth Sea Slug,** an anti-aircraft missile with semiactive homing being developed for four guided missile ships now under construction for the Royal Navy.

• **Bristol Bloodhound,** an anti-aircraft missile using semiactive homing and integrated into the existing radar network. Bloodhound has been ordered for the Royal Air Force.

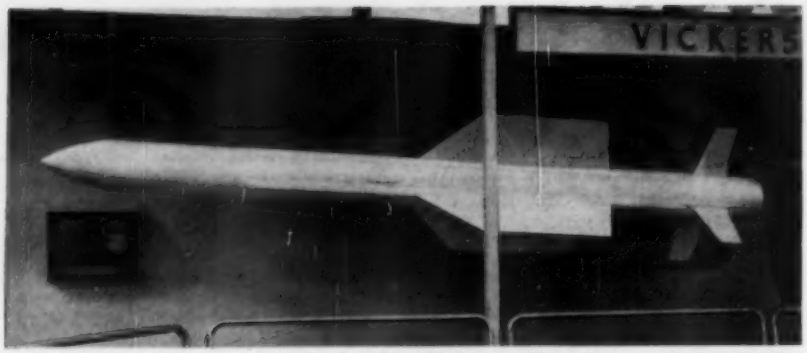
• **English Electric Thunderbird** also an anti-aircraft missile using semiactive homing and ordered by both the British Army and the RAF.

Behind these missiles are such test and training vehicles as the Fairey Fireflash, Short Bros. range of test vehicles, the Bristol Borzoi and Bobbin development rounds, and the Vickers Type 888 air-to-air rocket which was dropped when development of its carrier, a thin-winged Javelin, was canceled.

Both Bloodhound and Thunderbird are to be sold in exactly the same form to British and foreign customers. There will be no changes in the basic missile system. Both systems are adaptable, though, and will be changes in vehicle or transporter design should a prospective customer, for example, wish to use his trucks instead of British Army standard types.

Both these missiles are also being developed beyond their present capability in the direction of more range. Bristol with twin thor ramjets in its Bloodhound, is in a somewhat easier position to increase range than the Thunderbird designers, currently committed to the solid propellant sustainer in the missile.

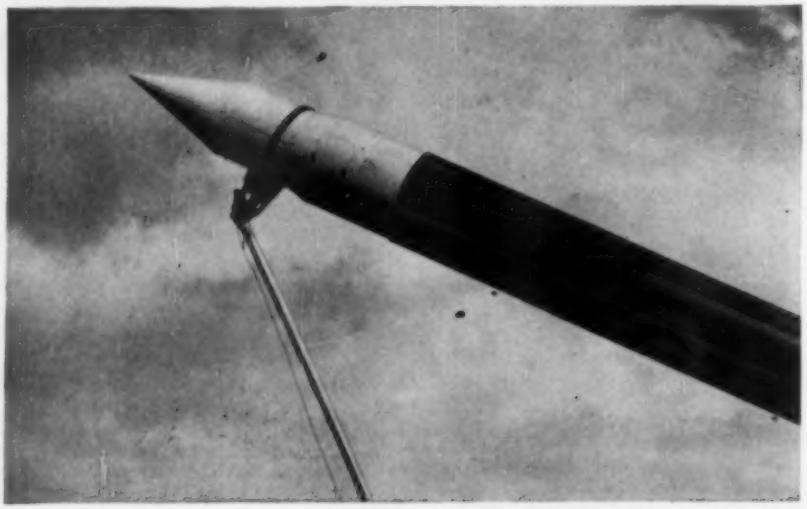
But earlier Thunderbird rounds were powered by a Napier liquid propellant rocket and there is a possibility that the shift back could be made to gain a range increment.

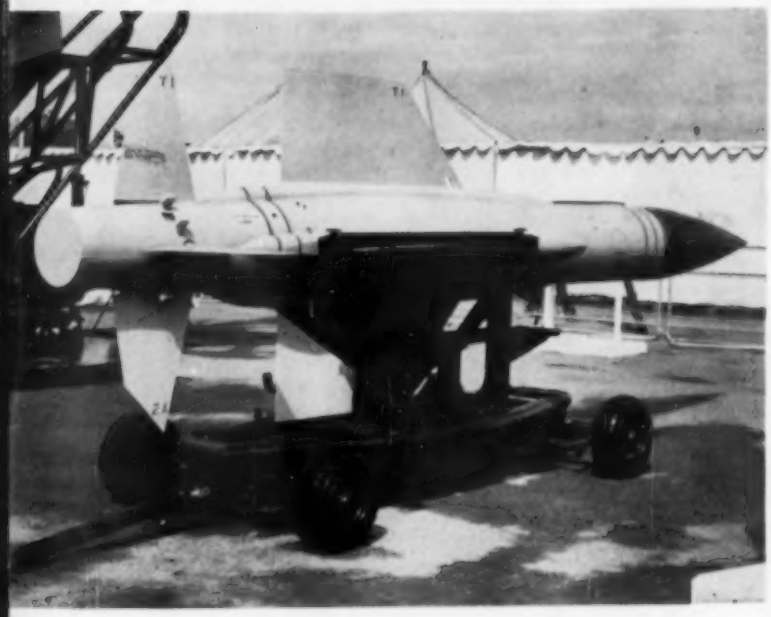


ANTI-TANK MISSILE, privately developed by Vickers as Type 891, is wire controlled through modified binocular guidance system. Gunner adjusts azimuth and elevation with thumbs. System, including transporter-launcher (left), weighs 40 lb.

VICKERS 888 MISSILE, originally named Red Dean, was air-to-air development carried only through flight testing. Fixed wings, fully-controlled slab tail surfaces are typical of nearly all current British missiles.

BRISTOL BORZOI test vehicle is primarily for development of Imperial Chemical Industries' large solid-propellant boosters. Double conical head indicates rocket may be used for gathering aerodynamic data.





Missiles at Farnborough Show British Trends

ENGLISH ELECTRIC THUNDERBIRD ground-to-air missile shows its aerodynamic lines on dolly (above) without booster cluster. Missile on launcher (right) includes boosters. Recovery parachutes are on Thunderbird test vehicle (below).

Navigation System Fight Faces ICAO

Montreal, Canada—Increasingly bitter controversy over choice of navigational aids for international adoption appears to be coming to a head here at sixth Communications Division meeting of the International Civil Aviation Organization.

While battle will center around short range navaids, both short range and long range systems are involved because basic disagreement is between philosophy of point source systems such as the U. S. Vortac and area coverage systems such as British Decca.

U. S. position favors modification of the previously accepted ICAO specification for VOR/DME to fit Vortac as international standard. U. S. also will offer, for an "exchange of views," information on Navarho, Loran C (Cytac), and Omega ground-based systems and declassified Doppler airborne navigators for long range navigation.

British are expected to press strongly for Decca, Dectra, Delrac complex. Composite system called Dian, shown at Farnborough, combined Decca and Dectra receivers with Decca's Doppler navigator developed for RAF under code name Yellow Lemon. French will present their short-medium range Radio Web system.

British press has pointed out that U. S. Air Transport Association stated it has no requirement for the distance measuring (Tacan) portion of Vortac and claims U. S. is furthering only the requirements of its military services.

British Expect Nuclear Aircraft To Reach Prototype in 15 Years

Folkstone—More than six hundred engineers and scientists representing a cross-section of the world's aircraft industries attended the 6th Anglo-American Aeronautical Conference here last week.

Conference is sponsored jointly by the Royal Aeronautical Society and the Institute of The Aeronautical Sciences, and is held alternately in the United States and England.

Sixteen technical papers were presented during the four-day session. Highlights of the papers included:

• **Estimate of 15 years** to reach the prototype stage for a nuclear-powered aircraft, made by Dr. J. V. Dunworth, head of the Reactor Division of the U. K. Atomic Energy Authority's Research Group. Dunworth further indicated that both time and cost of such a project were deciding factors in undertaking the work. Observers at the conference were shocked at what seemed to be a complete unawareness of the strides made in nuclear propulsion and published in the open literature, including AVIATION WEEK, which appeared several times in Dunworth's bibliography.

Discussions added little to the presentation.

• **Titanium** at its present cost—as high as $19 a pound—is not fully justified for civilian airplanes, commented Leo Schapiro and E. H. Labombard of Douglas Aircraft Co., Inc. In spite of the development of manufacturing techniques with negligible scrap during the nine years Douglas has been using the material, it is difficult to argue in favor of weight-saving properties of the metal on civil aircraft, they said.

• **Fail-safe and safe-life** design philosophies need to be followed in the design of modern aircraft, according to Dr. A. E. Russell, director and chief engineer of Bristol Aircraft, Ltd. General British design practice has centered around the safe-life idea where the American designers have used the fail-safe approach. Both are necessary, Russell argues, because many of the causes of damage are unpredictable. Using fail-safe principles can be expected to have significant effects, but is not likely to make revolutionary changes. Tests have shown that existing types of structure are fail-safe to a high degree.

Simple Fix Found For Grounded F8Us

Washington—Temporary grounding last week of Chance Vought F8U Crusaders in Navy's Atlantic Fleet squadrons is being remedied by simple installation of a fuel system bleed line. Grounding followed loss of fifth F8U since last December, four of them from experimental squadrons.

Problem was fuel starvation during combat maneuvers at high altitude, and failure of engine to restart. Air trapped in fuel lines cavitated the fuel pump.

Fix involves installation of a by-pass line which bleeds off air and permits fuel pump to reprime. Installation does not require pulling the engine or defueling the aircraft.

Except for VX (experimental) aircraft, only squadrons affected by grounding were VF-32 and VF-103, consisting of about 28 planes. Two days after grounding was announced, VF-32 was flying again. Pacific Fleet, which has lost no F8Us, did not feel problem was serious enough to warrant grounding.

Pilots have escaped death in all five Crusader losses. Three VX crashes involved ejection, one crash landed at sea.

All Crusader pilots have been instructed to report altitude and maneuvers of any future flameouts, whether relight was successful, and at what altitude relight occurred.

Douglas C-124s Used In Jordan Arms Lift

Washington—Eight Douglas C-124 Globemasters are taking part in the delivery of American arms to Jordan to help offset Soviet deliveries to Syria. The operation is under the direction of U. S. Air Forces Europe.

A report from Amman said planes landing at that city's airport with the gift arms, provided under the Eisenhower Doctrine, are charged a $75 landing fee.

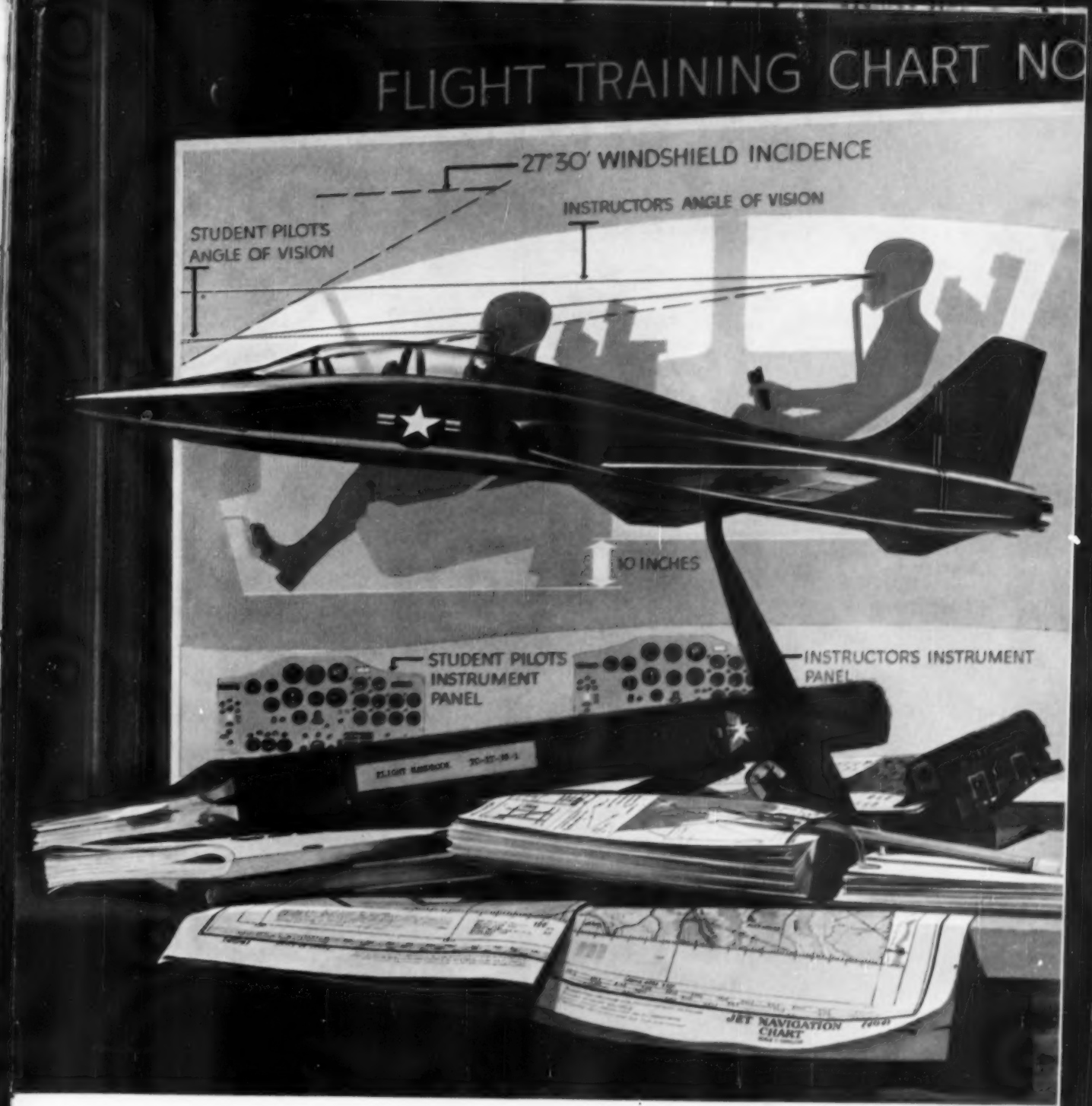
News Digest

Two Douglas A4D-1 Skyhawks were flown close to atomic explosions by Navy at AEC's Nevada test site during Operation Plumb Bob. Purpose of maneuvers was to evaluate blast and thermal responses of carrier-based aircraft to nuclear explosions and to study structural responses and other effects of atomic weapons.

De Havilland faces strike by almost 1,000 draftsmen unless company reopens negotiations on demand by union for third vacation week annually. Strike, threatened for Sept. 16, would affect about 12 factories, including plants at Hatfield, Watford, Stevanage, Chester, Lostock and Farnworth. Production would not immediately diminish.

Versatile-I, combination auto-plane developed by Dr. Robert L. Jackson of Central State College, Wilberforce, O., crashed Sept. 8. Pilot Edgar Parsley of Xenia, O., was killed when he attempted low-altitude turn and plane went into dive, crashing in woods near community of Xenia.

Solar Aircraft Co. is designing and planning to produce variable-speed gas turbine engine for flying platforms being studied by Army. Engine will be adaptation of constant-speed YT62, called by Solar the world's smallest gas turbine aircraft engine, which was designed for one-man helicopter.



SIMPLE ARITHMETIC– It costs approximately ten thousand dollars to send a student through college today, but more than ten times that amount to give a young man the superlative training that he must receive to become an Air Force pilot. A saving in either expense would be welcome to most Americans. Northrop Aircraft is ***doing something*** about reduction of national defense costs by applying "dollar engineering" to planning and production of new weapon systems. Latest Northrop achievement is its supersonic T-38 jet trainer, a simple, lightweight airplane capable of using any improved airport. Costing less to produce, fuel and maintain than other airplanes with comparable performance, the T-38 can save American taxpayers hundreds of millions of dollars in pilot training. This T-38 jet trainer...and the Snark SM-62, world's first intercontinental guided missile...are noteworthy developments of the budget-minded research, engineering and production teams at Northrop.

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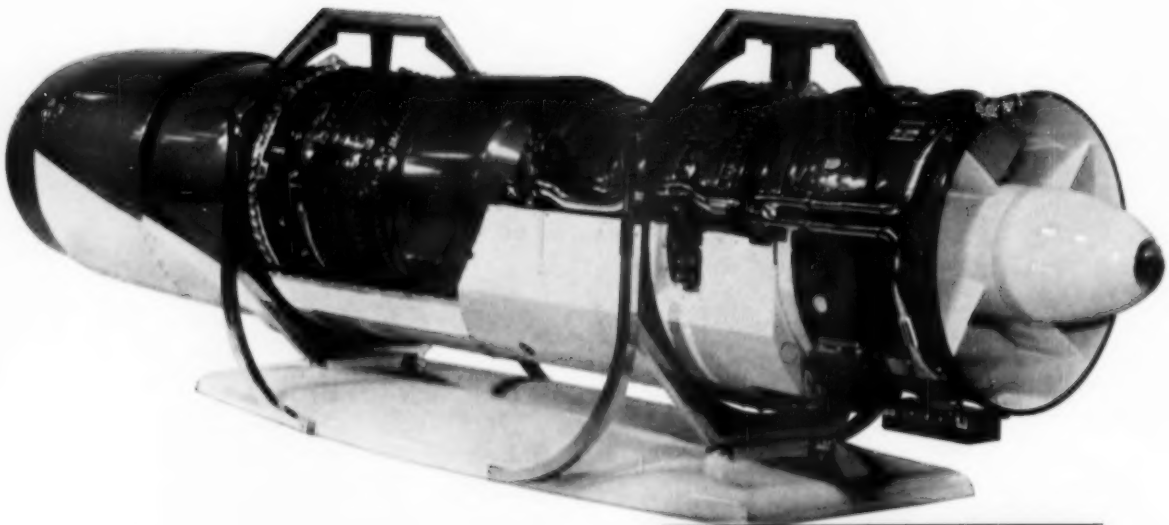

The Iroquois designed, developed and produced by Canadians is the supersonic successor to the Orenda jet engine, 4,000 of which are in service on four continents.

FLIGHT TESTING THE NEW IROQUOIS AT MALTON
The supersonic Iroquois is carried in this specially designed pod at the rear of a B-47.

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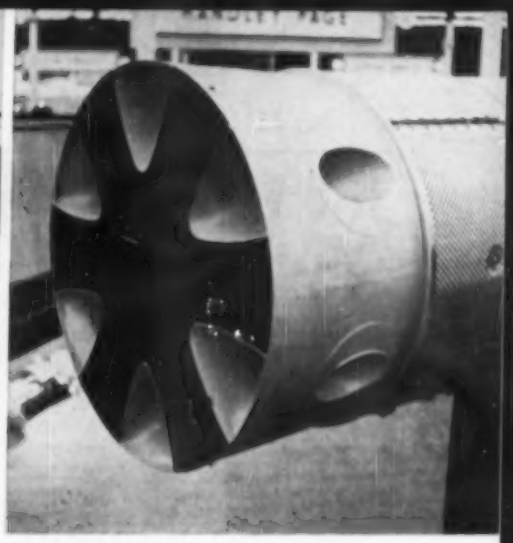
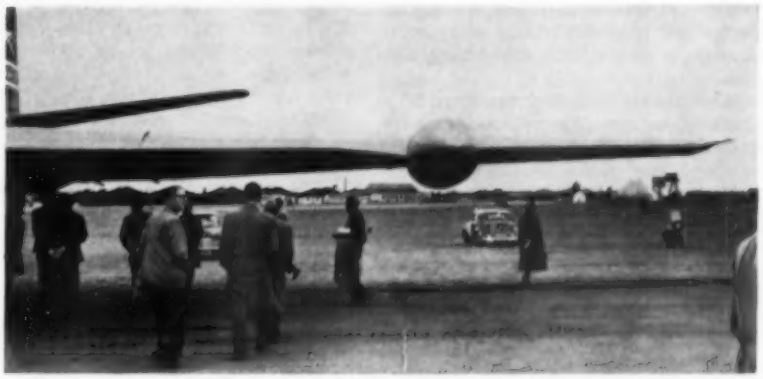


QUIETED COMET III rolls down runway (left), its four Rolls-Royce Avons fitted with tailpipe silencers (right).

Comet Suppressors, Feederliner Shown by British

De Havilland's Comet III was flown at Farnborough with silencers (above), drooped wing leading edge containing slots to improve local flow over wing (right). Aviation Traders Accountant (below), designed as a DC-3 replacement, was displayed carrying a spin-recovery parachute in its tail (below, right) for use in flight testing. Accountant is powered by two Rolls-Royce Dart turboprop engines. It is available with either a long-range, eight-seat executive interior or in short-medium range high-density 28 seat configuration for feederliner service.



Jet Profits Linked to Navigation Aids

IATA Technical Committee warns that large scale facility, research development program needed.

L. L. Doty

Madrid—International airlines last week were warned that operators of turbine-powered transports face economic losses unless a large-scale research and development program for air navigation facilities is adopted at once.

In its report to the 13th Annual General Meeting of International Air Transport Assn. here, the Association's technical committee told the 250 delegates to the convention that expenditure of funds must be sharply increased if airlines are to avoid "grave economic consequences" when jet transports are introduced. The committee also charged that implementation of facilities has lagged far behind planning and in many areas is already inadequate for present-day traffic.

The 80-minute review was based on a study of future airline operations with turbojet and turboprop transports. Here are the highlights of the report:

• **Navigation aids.** The committee reported progress in the development of self-contained aids, especially those based on the Doppler principle, but stated there is a "large market" for a simpler and less expensive aid for use in short-haul aircraft and helicopters.

• **Anti-collision devices.** Urgent need for a collision avoidance system as an adjunct to conventional ground-based air traffic control systems was underscored by the committee.

• **Secondary radar.** The committee told the convention that "little notable progress appears to have been made in the past 12 months" in the development of secondary ATC radar but expressed optimism that equipment proposals will be made to the International Civil Aviation Organization when its communications division meets at its next session.

• **Communications.** The committee reported substantial progress in the swing away from radiotelegraphy to air-ground communications and stressed the incorporation of uniform communications procedures in a single document for training and reference purposes as an ATA step last year.

• **Meteorological services.** A wide acceptance among governments of the principle that the role of meteorological service is to supply weather information, with the Air Traffic Services carrying the responsibility of disseminating the data to aircraft, was reported by the committee.

• **Licensing problems.** The committee reported progress in transferring pilot route familiarization responsibilities from governments to the airlines, adding, "these particularly onerous standards are on the way out—at long last."

In its discussion of navigational aids, the committee declared there is a growing realization that the primary purpose of navigational aids is no longer confined to assisting aircraft to fly between two points but is now the control of air traffic.

Consequently, the committee stated, the two chief air traffic control requirements are now the guidance of aircraft to permit execution of those flight maneuvers required by air traffic controllers, such as adherence to a defined track or holding pattern, and regular reports of aircraft progress or position so that controllers can maintain safe yet efficient separation of aircraft.

The committee concluded that the actual method of presenting navigational information in the cockpit in terms of progress along a pre-established track rather than as a geographical fix or as a fixed coordinate "may be of equal if not greater importance than the aid's system accuracy."

Only limited success was reported by the committee in attempts to establish the true air traffic control requirement for navigational air accuracy. The group called for an early answer to the question of accuracy requirements in order to resolve present differences of opinion and to accelerate the selection of future aids and encourage their implementation.

The committee favored the "aircraft separation monitor" as the most practical anti-collision device for over-ocean operations. It pointed out that the device—which is essentially a cooperative system—is being studied by various manufacturers but added that no specific technical proposals have been made to determine whether the system can be developed.

If developed, the aircraft separation monitor would permit a transatlantic aircraft to observe the relative position of other planes and to monitor continuously its separation criteria. Technically, the system is similar to the proximity warning device and the collision avoidance system. The committee said self-contained systems are not presently feasible, adding that international carriers probably will be forced to rely upon cooperative systems. Regarding communications services, the committee refused to forecast the degree to which its recommendations to the ICAO Communications Division would receive state support.

But the Division noted:

"The conclusions of this ICAO meeting will undoubtedly guide all important developments in the fields of communications and navigation for a number of years to come and very definitely influenced to a marked degree the effectiveness with which we can hope to operate the next generation of high-speed aircraft." The ICAO Communications Division is meeting this month in Montreal.

The committee told the convention that ICAO has decided to establish a special panel of representative operational, air traffic control, communications and meterological experts to review IATA proposals for the supply of weather information to aircraft. It added, "our preferred system for supplying aircraft with weather information is coming into service on a worldwide basis." Specifically, IATA members want the meteorological service to supply information to the Air Traffic Services which, in turn, will ensure dissemination of the data in accordance with the needs of aircraft.

The committee called delegates' attention to experiments conducted recently over the North Atlantic in the use of a radio-teletype system on low frequencies for the automatic receipt and recording of weather information. The committee pointed out that although first tests have been "highly encouraging," more experimentation and evaluation will be required before practical application of the system can be expected.

Standards requiring pilots to make at least one round trip familiarization including a familiarization flight at each regular and alternate airport with a check pilot may be abolished, the committee said. It pointed out that economic factors under such a system as well as time-consuming elements have

No IATA Move

Madrid—IATA voted to retain its headquarters in Montreal to defeat resolution of seven European airlines and Air India International to move to Geneva.

been particularly burdensome to the airlines.

The committee said a recent ICAO conference has recommended the discontinuance of these standards, replacing them with more general standards which put the responsibility of qualifying pilots for routes and airports on the airline and not the government, as it has been. The committee noted that certain new training techniques such as the use of wide-screen, color motion pictures has been found to be effective as a means of indoctrinating pilots to new routes and airports.

The committee emphasized the importance of airport visual aids for approach and landing and stressed that the need would increase substantially with the advent of jet transports. It recommended the provision of "fixed distance" markings on all runways at a distance of 1,000 ft. from the runway threshold to lessen undershooting. It also reported on narrow-gage, flush runway lighting similar to that now being installed at the Washington National Airport by the Civil Aeronautics Administration.

Guidance by IATA members to airport authorities in planning layout standards of taxi strips and fixed servicing facilities was urged by the committee. It called upon local authorities, communities and governments to tackle the problem of speeding air travelers from the airport to the city centers.

The committee reported failure in its attempts to obtain a single method of compliance with aircraft performance requirements. It said IATA's proposals met with limited support and two acceptable methods for airworthiness requirements—one patterned after the U.K. requirements and the other after the U.S.—have been approved.

The technical report was submitted to the IATA conference by Capt. Anselme V. J. Vernieuwe, Sabena Belgian Airlines. The committee consists of 18 airline experts from 13 countries.

New ALPA Contract Averts Braniff Strike

Dallas—Braniff Airways last week signed a new contract with the Air Line Pilots Assn., averting a strike scheduled by Braniff pilots early this month.

Negotiations between Braniff and ALPA reached a deadlock during the summer, and the dispute was resolved with the aid of government mediation only after ALPA scheduled, then cancelled a strike. New contract was signed on Sept. 9 providing a "satisfactory" settlement on wage, pension and working rules issues.

Old contract between Braniff and ALPA expired in January. Negotiations went into mediation.

CAB Opinion Charges Specht Used Emergency Power In 'Anger'

Washington—Civil Aeronautics Board last week charged that Trans World Airlines Captain Leonard J. Specht "irresponsibly" exercised his emergency authority in "truculence and anger" in order to obtain a preferred altitude on a flight from New York to St. Louis last Jan. 29.

The Board already has suspended Specht's air transport rating for six months on charges that he left his assigned altitude without permission, passing through an altitude occupied by a Capital Airlines transport (AW July 29, p. 43).

In issuing its final order detailing the reasons behind its decision, the Civil Aeronautics Board said:

- **Specht was not confronted by** a severe icing condition as he has claimed and that his action in leaving the assigned altitude was not justified by a situation that would reasonably lead him to believe that, unless he took immediate action, the safety of his aircraft, passengers and crew would be endangered.
- **In performing his emergency maneuvers,** Specht not only failed to exercise the highest degree of care but did not use even ordinary care and was therefore careless within the meaning of the Civil Air Regulations.
- **Specht failed to exercise** the degree of responsibility, care and judgment required of an airline pilot.
- **The public interest requires** the suspension of Specht's air transport pilot rating for a six-month period.

Suspension Appealed

After a hearing, CAB examiner S. Thomas Simon had recommended a six-month suspension of Specht's ATR air transport rating. However, both Specht and the CAA appealed and the case went before the Board. The Board adopted the findings and conclusions of the examiner but also found a lack of qualification and ordered his ATR revoked.

Civil Aeronautics Administration said the CAB order presents a clear-cut definition of airline pilots' emergency authority. The Airline Pilots Assn., however, declared that the decision further confuses the issue and may cause pilots to hesitate in declaring an emergency or taking immediate action to avert possible emergency situations.

CAB said the evidence, as well as a tape recording of the radio conversations between Specht and air traffic control at La Guardia, left no doubt that the examiner was correct in his findings that anger, rather than the necessity for action, was the primary motive behind his action.

It said:

"The impelling motive of Specht's action was not a belief that such action was necessary as involving a lesser risk than other alternatives, but rather was accumulating anger at being denied a change in his assigned altitude while the Capital flight continued to block his ascent by occupying the level which Specht had originally requested and to which he believed himself entitled.

No Mention of Icing

"During the several minutes of conversation preceding Specht's action, his growing anger was manifest, but at no time, though queried, did he mention icing.

"The abuse of the plane commander's emergency authority is serious, for such authority is intended for safety purposes only and cannot justify action not motivated by safety considerations."

"Thus," the Board said, "in obvious anger over not receiving an altitude to which he regarded himself as entitled, respondent deliberately and unjustifiably climbed his aircraft through space known by him to be occupied by another airline, and without exercising even ordinary care in the conduct of such a dangerous maneuver. Respondent needlessly jeopardized the lives of approximately 40 persons aboard his plane as well as of the occupants of the other aircraft.

"That this conduct demonstrates a lack of judgment and care is plain, and it is irresponsible to the extreme. The pilot who can control his plane but cannot control himself is not a safe pilot." The Board, however, has allowed Specht to retain his commercial pilot's certificate. The certificate will enable him to act as a co-pilot "under the supervision of other pilots-in-command."

Specht's Rebuttal

Specht, in defense, contended that a pilot must have the right to rely upon another who is in a responsible position and to assume that the other will act in accordance with his prescribed duties. He said he told the air traffic controller he had to leave his position and that it was up to the controller to move the other traffic out of the way.

He said emergency procedures provide that: "Upon receipt of advice that an aircraft is making an emergency descent through other traffic, immediate steps shall be taken to minimize con-

fliction with other aircraft." And, that ATC personnel should immediately notify all other aircraft in the vicinity of the emergency.

In exceptions to the examiner's decision, Specht said the examiner's interpretation of the emergency authority is that it can be utilized only when it is demonstrated that immediate action was either imperative or wise.

Examiner 'Unrealistic'

"The examiner goes on to reject what he terms a potential emergency," Specht said. "This, of course, is unrealistic and probably results from a lack of understanding of the pilots' position. This holding can only mean that the emergency authority is vested and can be utilized by the pilot only when there is an immediate necessity and in a good many instances this means until the worst has already happened."

This potential danger was his primary concern, Specht said. He said that in a matter of a few minutes at his prescribed altitude the ice had reached the point where, if something went wrong, there would have been serious, if not fatal, trouble. He therefore relied upon his judgment to take the corrective measures he considered necessary, Specht said.

Plan to Order DC-7D Canceled By American

New York—American Airlines has canceled plans to purchase Douglas DC-7D turboprop cargo transports because of what it terms the "difficult" airline financing picture.

American President C. R. Smith attributed cancelation of plans to "purchase a number of these new type planes" to Civil Aeronautics Board's recent decision denying a request by seven airlines for a 6% fare increase. In a letter to Donald Douglas, president of Douglas Aircraft Co., Smith declared:

"Airline financing has been difficult for some time. It is even more difficult now, for confidence in airline earnings and airline credit has declined substantially since the Civil Aeronautics Board issued the decision which denied even a modest increase in rates for the carriers. And airline credit will not be restored until there can be adequate rates and adequate earnings.

"The decision likewise has had an adverse effect on equity values. Indicative of this is the fact that the market value of the stock of American has declined nearly $6 million since the issuance of the rate decision by the Board."

Other possible purchasers of the proposed turboprop cargo versions of the DC-7 include Flying Tiger Line, which hopes to buy 20 if financing can be arranged, and United Air Lines (AW Sept. 9, p. 42).

Varig Selects 707s For N.Y.-Rio Service

Rio de Janeiro—Varig Airlines of Brazil has placed a $20 million order for three Boeing 707 Intercontinental jets plus spares. First deliveries are scheduled in July, 1960.

Another Brazilian airline, Panair do Brazil, plans to buy four Douglas DC-8s, and a third, Real-Aerovias, has ordered four Convair 880s (AW Aug. 5, p. 41). Order has not yet been placed by Panair do Brazil.

The equipment plans were presented to Brazil's foreign exchange regulator, who recently granted concessions to the airlines for foreign exchange credits in the purchases.

Varig's original petition for credits covered Caravelle and Viscount purchase plans, but the airline switched its request to the 707 project. Sud Aviation still expects to sell Caravelles to Varig, however, although less money will be available and an order for two of the French jets is more likely than the six originally considered. The smaller order now is "fairly firm," according to a Sud spokesman.

Varig's 707s will be powered either by the Pratt & Whitney JT4 (J75) or the Rolls-Royce Conway bypass engine. Aircraft will be operated in de luxe New York-Rio service with a flight time of 9½ hours, about half of present Super Constellation time on the route. The jets will be in 110-passenger configuration.

Northwest, United Push For Northern Traffic

New York—Battle between United Air lines and Northwest Orient Airlines for traffic on the northern transcontinental route is being stepped up this month with introduction of new nonstop services by both carriers. Edge in this competition has see-sawed during the past 30 days.

Northwest on Sept. 1 put newly delivered DC-7C equipment into its daily New York-Seattle service, with a stop at Chicago. United countered with announcement of nonstop DC-7 service between the points, to begin Sept. 15. Northwest then changed its plans, last week announced it will fly its DC-7Cs nonstop. The one-stop Chicago service will be eliminated.

Furthermore, Northwest will schedule New York-to-Portland nonstop DC-7C flights with both new services to be inaugurated Sept. 29.

Northwest's transcontinental nonstops will be flown in mixed first class-tourist configuration. Seating will be two abreast. United's service is all first class.

Northwest had installed a mockup of its DC-7C in its New York sales office to plug the new one-stop service. The mockup instead will now promote the nonstops.

Both airlines are scheduling their flights, which will be operated daily in each direction, with flying times of seven hours, 40 minutes eastbound, eight hours, 45 minutes westbound. Northwest's Portland flights will be scheduled on the same basis.

Northwest will sell optional hot meals to passengers on its tourist DC-7C flights.

Telephone Sales

New York—Some airline telephone operators here deliver little sales pitches along with their good-mornings in answering calls. For example, callers to local offices of three airlines are greeted as follows:

- **"United, the radar line, good morning."**
- **"Fly Eastern to Mexico, good morning."**
- **"Fly National, good morning."**

Rail Anti-Trust Suit Reaches Appeals Court

Washington—U. S. Court of Appeals last week took under advisement an appeal by 42 railroads to reverse a district court ruling that they violated anti-trust laws by collectively setting rates for government shipments.

The suit was brought against the railroads early this year by the Aircoach Transport Assn. representing non-scheduled airlines.

This group is now merged in the Independent Airlines Assn.

The plaintiff airlines charged that the railroads offered rate reductions of from 10% to 50% less than regular rates when competing with airlines for military charter business and asked $45 million damages.

U. S. District Judge Joseph C. McGarraghy in July ruled against the railroads and signed an order enjoining them from continuing such practices. The amount of damages was left to be resolved by trial.

Although the suit was brought by five airlines, 26 additional carriers have now joined the case, boosting the damages asked to $144.6 million.

Meanwhile, Congress passed legislation permitting joint action by railroads for the consideration, initiation and establishment of such rates. It stipulated, however, that the bill was to have no effect on the pending court case.

Northwest Protests Eisenhower Decision

By Ford Eastman

Washington—Northwest Airlines denied last week that there has been a sufficient increase in U.S.-Orient traffic to justify reconsideration of Pan American World Airways' bid to serve Seattle and Portland on the Great Circle route.

President Eisenhower has asked the Civil Aeronautics Board to reopen the Transpacific Route Case to the limited extent of deferring final decision on Pan American's application (AW Sept. 9, p. 25). The request reversed an earlier presidential approval of a CAB recommendation that PAA be denied authority to serve the two cities and parallel Northwest's Orient route.

Nyrop Rebuttal

The President said it had come to his attention that there may have been substantial increases in traffic between the U.S. and Tokyo. In addition, the President said, legislation granting Northwest a permanent certificate on the New York-Chicago, Minneapolis to Anchorage route may have the effect of reducing the number of Northwest flights from Portland-Seattle to the Orient.

Northwest President Donald W. Nyrop said the latest traffic figures were part of the record and available to the President.

There could be, Nyrop maintained, no startling change between Aug. 2, when President Eisenhower approved the CAB recommendation that Pan American be denied the route, and Sept. 3 when he asked that the case be reopened.

As for the New York-Chicago, Minneapolis to Anchorage route, Nyrop said the legislation merely changes the authority from temporary to permanent. Northwest Airlines has been operating this route for several years.

The latest traffic figures presented by Northwest in the case were for the 12-month period ending on last May 31.

They are:

- **Revenue passenger miles**—Northwest 19.9%; Pan American 80.1%.
- **Revenue ton miles**—NWA 25.5%; PAA 74.5%.
- **Passenger load factor**—NWA 56.5%; PAA, 70%.
- **Weight load factor**—NWA 67.8%; PAA 66.5%.
- **Average number of passengers** per trip—NWA, 28; PAA, 40.

Other figures presented by Pan American show that all U.S.-Orient traffic by American flag carriers amounted to 1,384 passengers in September 1955; 1,473 in March 1956; 2,101 in September 1956 and about 2,000 in March 1957.

Pan American Petition

Pan American took exception to the Board's decision denying it stops at Seattle and Portland and filed a petition for reconsideration on the same day the President asked the CAB to issue a new order withholding the decision.

In its petition for reconsideration, Pan American said the Board's opinion contains an erroneous analysis of the effect such an operation would have on Northwest Airlines and of the comparative strength of the two carriers. In support, the airline offered these arguments:

- **Board's estimate of diversion** from Northwest of $11 million is excessive. Pan American said that by diverting some of its flights through Portland and Seattle, it also would divert some of its traffic over the route, thereby strengthening the North Pacific route.
- **Board's analysis of relative strength** and size of the two carriers is misleading in material respects. Pan American said that, in deciding what its competitive position against Northwest should be, there is no more reason to include Pan American's operations to Hawaii, to the South Pacific or to Alaska than there would be to throw in the transatlantic or the South American services where other carriers provide competition. Conversely there is even less reason to exclude Northwest's domestic operations, all of which are an integral end-on part of its transpacific services.
- **Opinion fails to state** the basic facts which show that such service by Pan American is in the public interest. The airline said Seattle and Portland are the West Coast gateways that afford the most direct service to the Orient for an area which comprises 85% of the nation's population and resources and which produces more than half of the traffic from the U. S. to the Orient. Because of restrictions, the frequencies cannot be increased at will. The result of this, the airline maintained, is that both carriers are operating with substantially full capacity loads and each is carrying about half of the traffic. This means, Pan American said, that a substantial amount of the traffic generated by those areas having 85% of the nation's population must use the California gateways for service to the Orient. It protested that the only purpose in forcing these passengers against their will to detour 800 miles via the California gateways is to provide Northwest with a competitive cushion it does not need.
- **Subsequent to the President's** approval of the decision, legislation has been enacted which makes permanent Northwest's route between the New York and Chicago co-terminals and Anchorage, Alaska. This route affords Northwest an additional competitive advantage of 360 miles from New York and 200 miles from Chicago over that which it already enjoys through the Seattle gateway.

Northwest Bid Denied

In presenting Northwest's case, Nyrop charges that Pan American has the strongest U.S.-Tokyo route which generates about 70% of the traffic as compared with Northwest's 30%. He also complains that the White House turned down a Board order to hear Northwest's application to compete on Pan Am's route last year.

This is the second time in less than three years the President has withheld or withdrawn his approval of the CAB's recommendations regarding a Pan American Great Circle route to the Orient.

Polar Battle

Los Angeles—Pan American World Airways late last week planned to go through with the inaugural of its Polar service to Europe despite confusion over whether the flight would be permitted to land at its Paris destination.

Earlier last week, the French notified the State Department that Pan American might not be permitted to land at Paris unless the U.S.-French air agreement was reopened to permit Air France access to the U. S. West Coast. The flight was scheduled to leave for Paris from San Francisco and Los Angeles.

France claimed the current bilateral between the two countries does not authorize a U.S. carrier to fly from the West Coast to Paris via the Polar route. U. S. authorities said in rebuttal that the agreement allows U. S. carriers to fly from any point in the U. S. to specified points in France, while French flag carriers can fly from any point in France to specified points in the U. S.

After receiving the French terms, the State Department, Civil Aeronautics Board and airline officials adopted a firm stand against yielding to the demands. The State Department did indicate, however, that it might be willing to conduct further discussions on the French requests if France modifies its stand.

BONANZA AIRLINES, NOW SERVING
SIXTEEN CITIES IN NORTH AMERICA, HAVE ORDERED
ROTOL PROPELLERS AND EQUIPMENT
FOR THEIR FLEET OF FAIRCHILD F-27 SILVER DART AIRCRAFT

The Hoover Dam, one of the world's outstanding engineering achievements stands mid-way between Nevada and Arizona, bringing control to the turbulent waters of the Colorado River.

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Mayors Warned Nation's Airports Lack Preparation For Jet Service

New York—Today's airports are sadly deficient in meeting the nation's aviation demands, members of the United States Conference of Mayors were told last week by Milton W. Arnold.

This is true both of facilities now available and those being planned, the Air Transport Association's vice president, operations and engineering, said.

Adequate navigation and landing aids, protected and unprotected airspace and modern, flexible airports are needed to meet aviation requirements, Arnold told the conference members, who are mayors of cities of 50,000 or more population.

Among the problems to be faced by communities with arrival of the jet age of commercial air transport is that of aircraft noise, a "serious consideration that cannot be overemphasized," Arnold said. Noise has been an important factor in the past and will certainly not decrease with increasing traffic.

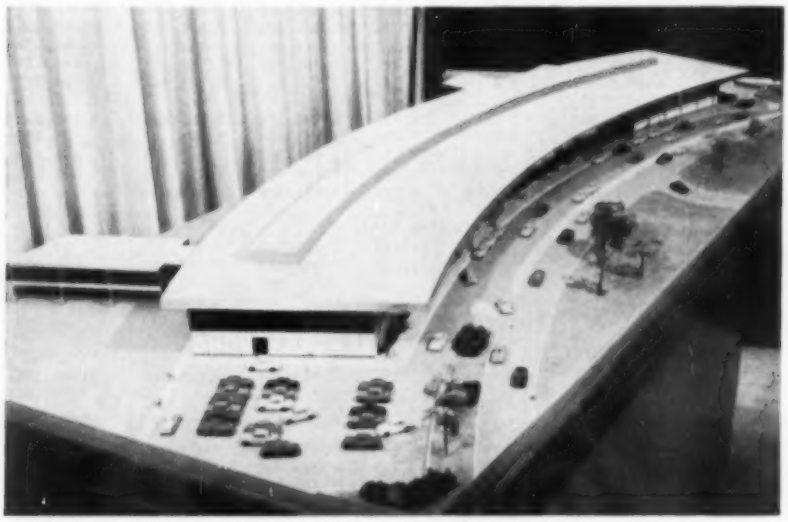
The civil jet, however, will not be more of a problem than propeller-driven planes except initially, Arnold predicted.

"We may expect more complaints with the initial operation of jets because of the different pitch of their noise," the ATA official said. "If the jet muffler proves to be a success, and I believe it will, the problem of noise nuisance will be greatly reduced," Arnold added.

Runway length requirement for large new jet transports, at maximum gross with liquid injection, will be 10,650 ft. for takeoff under zero wind conditions at sea level on a 100F day, Arnold said. On a 90-deg. day at a location 2,500 ft. above sea level, 11,500 ft. of runway will be required for maximum operation.

One method airlines may use to avoid such extreme requirement, Arnold told AVIATION WEEK, is to schedule the longest flights, where gross weight will approach maximum, at a time of day when temperature will be less of a factor. In any case, he pointed out, most flights will not encounter such conditions at most airports. In some instances payloads will be cut if necessary.

Many considerations will remain the same for jets as for piston planes in providing airport facilities, Arnold told the mayors. But some airport shortcomings will be more pronounced in jet operation. A deficiency in airport landing and visual aids, Arnold said, will result in poorer jet transport reliability than piston reliability. An efficient system of taxiways, turnoffs, passing areas and ramps also will be more vital for jets. Poor wind orientation of runways also will adversely affect the jet to a slightly greater extent than the propeller plane.



Idlewild Terminal for United

United Air Lines plans $10 million passenger terminal at New York International Airport. Model of the proposed facility is pictured. Building will be 691 ft. long, total 191,000 sq. ft. of floor space, features a 25-ft. overhang running the length of the building for weather protection. Financing for terminal, which will be United's largest passenger handling facility, has been arranged with Port of New York Authority under 25-yr. lease. Construction is scheduled to begin this fall with completion scheduled in June, 1959.

New Instrument Runway for Idlewild

New York—Port of New York Authority is expected to announce this month plans for construction of a new instrument runway at New York International Airport. The runway, which most probably will be called upon to handle transatlantic and transcontinental jet flights despite present ban on jets at Idlewild, will be 8,400 ft. long and 3,000 ft. east of the present runway 4-22 which it will parallel.

The new runway will be used as a landing runway, and approach lights to the present instrument strip will be relocated to serve the new runway. The lights extend out into Jamaica Bay.

The Port Authority is also working out a plan to extend the existing 8,400 ft. 4-22 to a length suitable for most maximum-range big-jet operations. Negotiations with airlines involve adding 700 ft. to the northeast, or land, end of the runway, and extending the southwest end out into the bay.

Guaranteed Loan Bill Signed By President

Washington—Civil Aeronautics Board last week announced it would begin immediately to establish machinery to administer the provisions of the government Guaranteed Loan Bill signed earlier in the week by President Eisenhower.

The bill, sponsored by the CAB and endorsed by the Assn. of Local and Territorial Airlines, is designed to aid local service and feeder airlines in obtaining loans with which to purchase new and modern equipment. The carriers had claimed that their poor earning ability made it difficult to obtain the necessary financing for new equipment without government assistance.

The act authorizes the CAB to guarantee loans of up to $5 million an airline providing that the airline is unable to secure satisfactory financing elsewhere. The government will guarantee private loans made by lending institutions up to 90% of the purchase price of the new equipment.

A total of 28 local, territorial and helicopter lines are eligible to participate in the program, according to the CAB. Application forms are expected to be ready for delivery soon.

Earlier, the President signed a bill to amend the Bankruptcy Act to give lending institutions first call in taking possession of equipment upon which loans had been made in case of bankruptcy. This bill had the backing of members of the Conference of Local Carriers.

Airline Income and Expenses—Second Quarter, 1957

(In Dollars)

	Passenger Revenue	Mail Revenue (U. S.)	Property Revenue	Federal Subsidy	Charter Revenue	Total Operating Revenue	Total Operating Expenses	Net Income (before taxes)
DOMESTIC TRUNK								
American	71,578,035	1,730,821	6,090,578	.....	22,139	79,848,397	70,689,149	9,987,714
Braniff	12,794,224	326,796	611,522	.....	14,323	13,819,441	12,600,194	1,039,277
Capital	23,591,895	464,321	730,513	.....	19,532	24,899,858	23,202,675	1,100,230
Continental	5,167,258	125,729	217,074	17,273	217,074	5,591,726	5,447,728	35,998
Delta**	.....	.....	.....	.....	.....	.....	.....	.....
Eastern	58,998,419	1,134,549	2,401,904	.....	22,188	62,889,700	60,215,255	4,432,089
National	12,151,522	260,562	735,542	.....	33,804	13,354,685	11,837,718	1,511,833
Northeast	2,910,886	41,498	130,376	365,090	343	3,474,243	4,115,224	−629,000
Northwest	12,685,292	434,045	1,035,633	.....	14,882	14,283,342	13,443,124	1,129,411
Trans World	45,624,227	1,092,405	2,565,198	.....	33,226	50,218,551	47,758,493	2,921,631
United	61,770,953	2,318,479	4,545,260	.....	276,234	69,344,044	64,481,512	4,766,505
Western	9,546,129	253,445	395,194	.....	7,638	10,222,526	8,812,895	1,349,480
INTERNATIONAL								
American	1,178,187	16,338	206,163	.....	.....	1,434,737	1,419,645	34,983
Braniff	1,690,215	26,998	190,047	.....	213,176	2,217,089	1,931,587	260,066
Caribbean-Atlantic	438,622	6,174	15,700	.....	6,689	482,186	409,032	73,050
Delta**	.....	.....	.....	.....	.....	.....	.....	.....
Eastern	.....	.....	.....	.....	.....	.....	.....	.....
National	706,024	.....	53,629	.....	5,195	766,271	812,623	−47,519
Northwest	4,716,991	1,423,360	886,932	.....	16,845	7,296,998	6,139,086	1,182,100
Pan American								
Alaska	1,207,461	60,262	207,709	.....	56,852	1,559,640	1,984,788	−422,969
Atlantic	29,816,743	1,762,791	2,806,813	.....	1,252,111	36,698,147	30,926,244	5,825,187
Latin America	17,254,418	538,007	3,664,122	.....	600,770	22,842,712	23,907,912	−982,351
Pacific	14,550,930	1,335,383	2,124,571	1,453	1,943,794	20,642,899	18,900,131	1,758,745
Panagra	3,657,845	117,432	565,934	.....	74,198	4,970,495	4,910,899	111,451
Trans World	13,734,811	1,259,473	1,751,204	.....	340,683	17,203,285	15,622,417	1,580,284
United	3,228,718	102,651	63,504	.....	.....	3,435,444	2,895,999	508,447
LOCAL SERVICE								
Allegheny	1,365,079	22,078	71,191	652,003	10,027	2,129,728	2,061,335	49,707
Bonanza	472,956	8,581	19,885	287,277	17,931	809,945	823,951	−13,337
Central	380,013	10,227	18,512	665,628	6,588	1,085,018	1,023,457	58,098
Frontier	836,873	27,463	83,541	618,469	14,364	1,593,278	1,659,783	−72,050
Lake Central	409,632	10,793	18,428	379,954	5,863	825,367	862,395	−46,650
Mohawk	1,361,387	15,218	64,200	277,327	23,131	1,741,263	1,940,000	−198,737
North Central	1,880,089	54,561	41,806	374,576	63,049	2,418,553	2,391,947	−184,333
Ozark	.....	.....	.....	.....	.....	.....	.....	.....
Piedmont	1,408,277	26,247	49,125	617,615	26,814	2,175,176	2,073,489	107,369
Southern	586,351	25,789	16,215	498,834	12,431	1,142,654	1,119,357	21,036
Southwest	1,000,913	29,013	24,345	449,554	22,539	1,530,292	1,486,573	25,516
Trans-Texas	851,734	29,716	50,222	735,990	21,365	1,697,413	1,673,143	24,701
West Coast	657,370	12,537	18,669	403,626	6,054	1,102,525	1,091,809	−6,827
HAWAIIAN								
Hawaiian	1,177,246	10,173	176,545	.....	54,850	1,488,345	1,391,924	68,667
Trans-Pacific	551,325	3,227	26,913	.....	22,848	623,371	606,391	14,397
CARGO LINES								
Aerovias Sud Americana	.....	.....	413,126	.....	78,826	512,529	515,331	−16,835
Flying Tiger*	.....	.....	.....	.....	.....	.....	.....	.....
Riddle	.....	.....	.....	.....	.....	.....	.....	.....
Seaboard & Western	.....	.....	.....	.....	.....	7,154,603	6,048,839	1,105,764
Slick	.....	.....	.....	.....	.....	.....	.....	.....
HELICOPTER								
Chicago Helicopter	56,825	19,589	829	233,937	.....	317,973	310,590	−3,748
Los Angeles Airways	45,925	32,738	16,568	232,527	3,429	331,480	290,726	38,272
New York Airways	145,371	13,679	15,372	315,247	8,451	509,956	633,781	−123,067
ALASKAN								
Alaska Airlines	405,118	140,031	217,792	304,383	288,753	1,337,057	1,427,471	56,371
Alaska Coastal	191,724	28,191	29,983	94,030	24,703	379,354	309,215	71,395
Cordova	33,608	23,298	21,571	61,723	353,607	499,581	451,431	30,941
Ellis	159,298	13,798	22,506	66,914	14,476	279,278	244,112	33,912
Northern Pacific	1,639,042	168,645	265,971	390,203	13,002	2,495,890	2,279,143	182,534

*Not available. **Delta filing for fiscal 1957 at end of September.
Compiled by AVIATION WEEK from Airline Reports to the Civil Aeronautics Board.

Shipping Buck Cuts J57 Airlift Cost

New York—Use of a relatively lightweight shipping buck instead of a metal can is providing savings for Boeing Airplane Co. in airlifting of J57 engines to its Seattle plant.

Flying Tiger Line, with a contract to transport 600 of the engines for Boeing's 707 production line, reports that the bucks not only reduce tare weight and cost less than the cans, but also allow loading in the C-46, which couldn't accommodate the cans.

The cargo carrier has lifted about a dozen J57s so far under the contract. It flies them by C-46 directly from Pratt & Whitney's plant at East Hartford, Conn., saving a truck move to Newark Airport for DC-6A loadings.

Cost of Cans

The can-type container, according to Flying Tigers, costs more than $1,200 and weighs 3,780 lb. with the 3,997 lb. engine, total weight of the shipment was 7,777 lb. At $15 per 100 lb., cost of the shipment was $1,042.12, or a total of $2,242.12 including the cost of the can. The engines move by deferred air freight with its consequently lower rates.

With the buck, which weighs 723 lb., total shipment weight is 4,720 lb. The shipment moves at the lower rate of $13.70 because of the reduced volume, so the cost is $646.64. Add $600 for the buck, and the total cost is $1,246.64.

Flying Tigers expects the bucks to cost 50% less, depending on quantity.

By using bucks and deferred service, Boeing will save $291.20 per engine over railroad car lot shipment of engines in cans, according to Flying Tigers' calculations. Comparison includes cost of the containers.

With the shipping buck system, an engine is lowered into the cradle, secured to its four arms and covered with a nylon-type sleeve to protect it from dust and moisture. Savings also apply on the return trip because the bucks are lighter, smaller than cans.

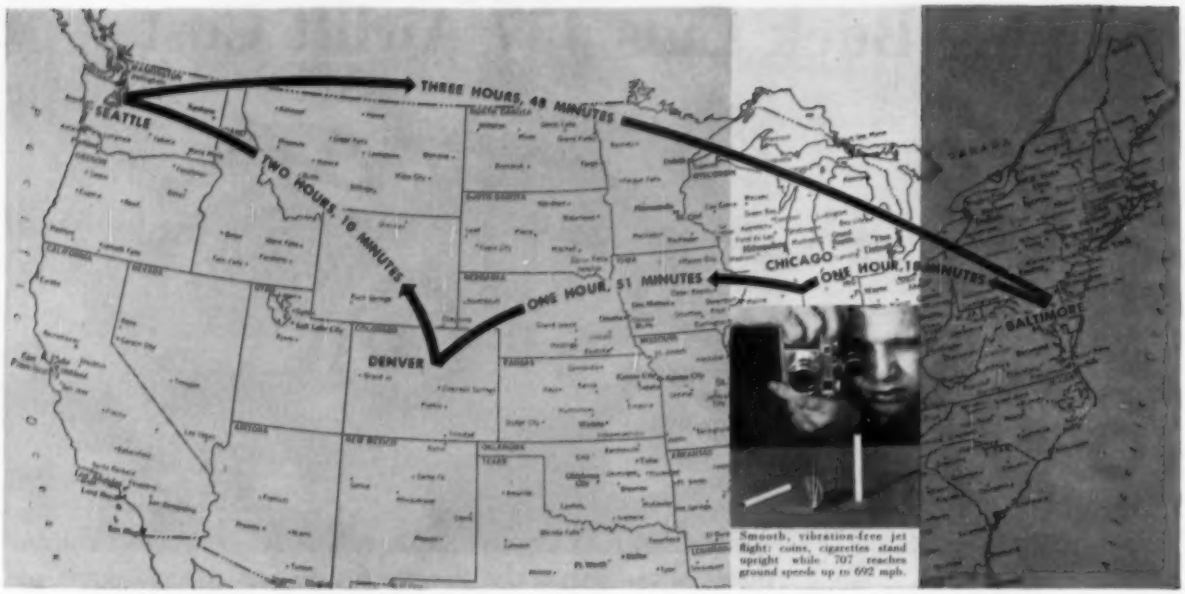
Boeing Idea

Flying Tigers attribute the buck idea to Boeing's traffic supervisor, Leo Meyers. The cargo airline is presenting the program to other commercial and military prospects.

The airline is using the program to emphasize to military transportation officials the prospective savings in reduced packing and crating requirements in this kind of operation. Flying Tigers reports previous military development of a dolly type of shipping buck to replace engine cans, but says the new plan adds usefulness and efficiency.

ENGINE IN CAN won't fit C-46 door. The container weighs 3,780 lb.

SHIPPING BUCK is lighter—723 lb.—and, with engine, fits easily into the plane.


THREE HOURS, 48 MINUTES
SEATTLE
TWO HOURS, 18 MINUTES
ONE HOUR, 51 MINUTES
DENVER
CHICAGO
BALTIMORE
Smooth, vibration-free jet flight: coins, cigarettes stand upright while 707 reaches ground speeds up to 692 mph.

In the only American jetliner now flying—the Boeing 707—newsmen recently flew coast-to-coast in 3 hours, 48 minutes, a new transport record. Their report on 707 jet flight: Quiet. Smooth. Exhilarating!

Around the world...across the country—jet aircraft built by Boeing are repeatedly demonstrating their advanced performance and reliability. Such demonstrations are a preview of what *you* can expect from the 707—America's first jet transport.

These airlines already have ordered 707s: AIR FRANCE • AIR INDIA • AMERICAN • B.O.A.C. BRANIFF • CONTINENTAL • LUFTHANSA • PAN AMERICAN • QANTAS • SABENA • TWA

BOEING 707

SHORTLINES

▶ **Argentine Air Ministry** plans to build an international helicopter airport in Buenos Aires. A Ministry spokesman said the airport will be situated near the docks at a point accessible to the business center of the city. It is to be used initially by helicopters belonging to various state organizations, including the naval and railway hospitals, and for operation of a helicopter postal service between Buenos Aires and La Plata, capital of Buenos Aires province. Later, facilities will be available for handling regular passenger and freight traffic, including service to Uruguay.

▶ **Mohawk Airlines** reports new company records in passengers boarded and passenger miles flown during August. The airline boarded 40,055 passengers to exceed its previous mark of 39,463 set last October. The figure represents a 22.6% increase over August, 1956. Passenger miles flown totaled 7,490,285 as compared with the previous high of 7,226,802 in June. The August record was 29.8% higher than August 1956. Airmail last month was 13.8% higher than in 1956, express 16.1%, freight 80%.

▶ **Ozark Air Lines** set a new traffic record for itself last month by carrying 41,785 passengers, a 37% increase over August, 1956, when the airline carried 30,264 passengers. On August 30, Ozark also set a record for passengers boarded in a single day with 1,680. The airline will observe its seventh anniversary as a local service carrier on Sept. 26.

▶ **Trans World Airlines** last week began Lockheed 1649A Jetstream service between Washington and Los Angeles. The new nonstop flight has both tourist and first class accommodations. Earlier, TWA began similar service between Washington and San Francisco.

▶ **Southern Airways** last month boarded 20,300 passengers to set record for the airline in the number of passengers flown in a single month. Southern flew 3,600,000 passenger miles during August for a 20% increase over August, 1956. The airline, with offices in Atlanta, serves 31 cities and eight southern states.

▶ **Lake Central Airlines** had a record month in August, boarding 16,207 passengers throughout its system for a 23% increase over August last year. Previous high was in May when the airline boarded 15,319 passengers. The boarding of 712 passengers on Aug. 23 also set a company record for a single day.

AIRLINE OBSERVER

(The following column was written by Aviation Week *Transport Editor L. L. Doty who is attending the 13th Annual General Meeting of the International Air Transport Association in Madrid.)*

▶ **International airlines will take joint action next year in efforts to combat mounting costs that, so far, show no sign of slackening. However, most airline officials present at the 13th annual General Meeting of IATA in Madrid last week were pessimistic over the industry's ability to stem the cost rise. In addition to increases in every category of operation, airlines have been faced with increases in landing fees and other airport charges ranging from 20 to 75% during the past year. Certain governments are threatening to impose passenger service charges. Furthermore, possibility of user charges against carriers for use of air navigation facilities on international routes is gaining strength.**

▶ IATA Traffic Conference to be held next week in Miami will vote on a no-show program similar to that adopted earlier this year by U.S. domestic airlines. Estimated loss to international airlines resulting from the no-show problem is $29 million annually.

▶ **Renewed interest by manufacturers in the transport market is evidenced by large representation of leading airframe, engine and avionic companies at the IATA meeting. A total of 15 companies from four countries were represented. Eleven U.S. manufacturers plus the Aircraft Industries Assn. were present with United Aircraft having the largest contingent—17 members.**

▶ Airline association formed in Madrid by carriers operating in Spain is indicative of recent move by airlines to combine efforts in the solution of local problems as a supplement to IATA activities. The 19 airlines that serve Madrid have already improved operating facilities and ground handling facilities in Spain through the association activities.

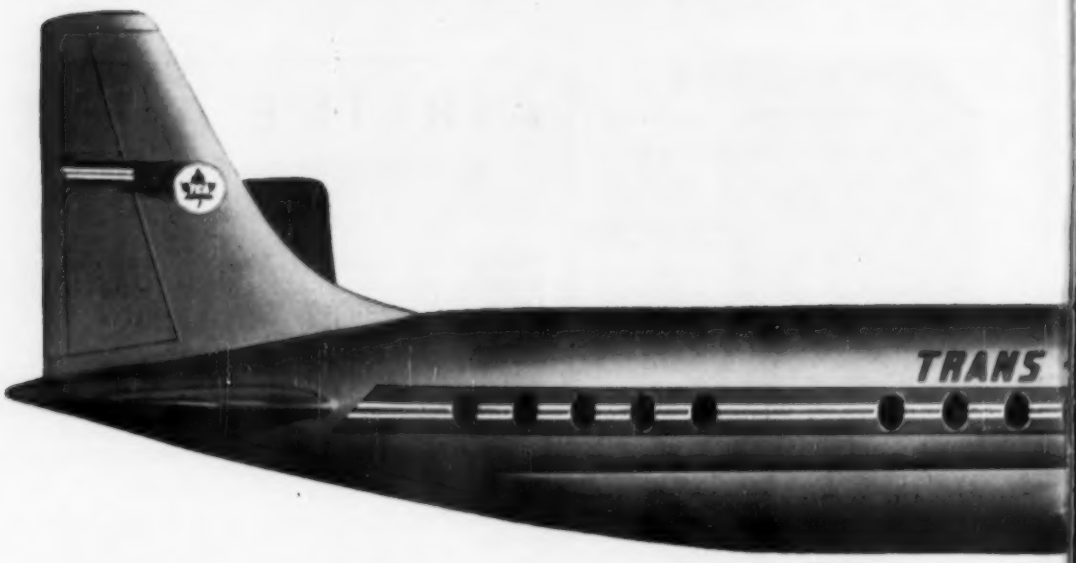
▶ **Watch for approval by the IATA Miami conference on an air-sea interline agreement over North Atlantic routes. The proposal, if approved, will be subject to acceptance by shipping interests. It is designed to smooth out transfer of passenger traffic between sea and air.**

▶ International airlines are showing increasing concern over the strong likelihood of a sharp break in prices in the aircraft resale market once turbine-powered transports appear in large numbers. Iberia Spanish Airlines president Tomas Delgado warned that airline managements may face a dwindling of negotiable assets because of the depreciation rate on many aircraft in the world market (AW, Sept. 2, p. 37).

▶ **IATA member airlines have agreed to support a resolution calling for recommendations to governments that transport insurance practices which restrict international trade be eliminated. Specifically, the airlines want to see the end of the present policy of some governments that requires carriers to obtain liability insurance locally. Insurance costs are substantially increased when countries refuse to accept a certificate from the airline's insurer stating that the carrier's liability is fully covered.**

▶ Mechanized methods for handling reservations, ticketing and fare computation on an interline basis are gaining strong support among international carriers as an essential step toward simplifying passenger handling. Some carriers have adopted electronic data processing systems for reservations on an on-line basis but the program has not been expanded to cover interline business. Meanwhile, IATA is studying electronic computation equipment as a means of accelerating the evaluation of rate proposals and amendments to rate levels.

▶ **International rate structure may come up for a complete overhauling shortly. IATA members would like to see a less complex rate structure to increase efficiency and eliminate competitive abuses. It is very likely that helicopter fares may be integrated into the IATA fare pattern.**



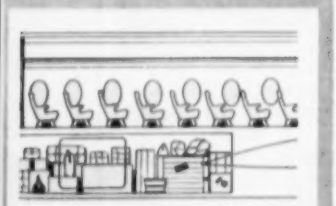
UNMATCHED OPERATIONAL

FLEXIBILITY

THE NEW DOUBLE-DECK JET-PROP **VANGUARD**

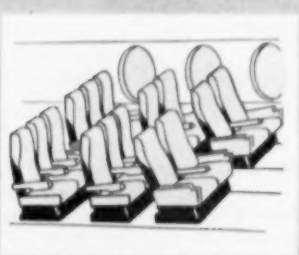
Without a doubt, the new Vickers Vanguard offers the greatest operational flexibility of any airliner ever designed. Though it is a de luxe passenger liner first and foremost, the Vanguard can, when required, operate profitably as an *all-cargo* plane! Result: the Vanguard is truly a *full-time* money-maker! Vanguards have already been ordered by British European Airways and Trans-Canada Air Lines. BEA ordered twenty. TCA also ordered twenty—with an option on four more—deliveries to start in early 1960. Into each Vanguard will be built over 2 million flying hours of Vickers jet-prop experience. And experience has no substitute!

2-IN-1 AIRCRAFT!



Because of its double-deck fuselage design, the new Vickers Vanguard is actually *two* aircraft in one! Though primarily a most economic passenger plane, it can also operate profitably as an all-cargo plane. Result: the Vanguard offers extraordinary operational flexibility—unmatched by any other airliner.

76, 86, 93, 120 PASSENGERS!

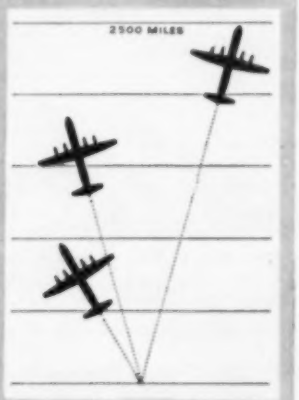


The Vanguard's luxurious upper deck passenger cabin features exceptional flexibility in layout . . . with capacities ranging from 76 for all first-class, up to 120 plus crew for all tourist — with mixed-class combinations in between.

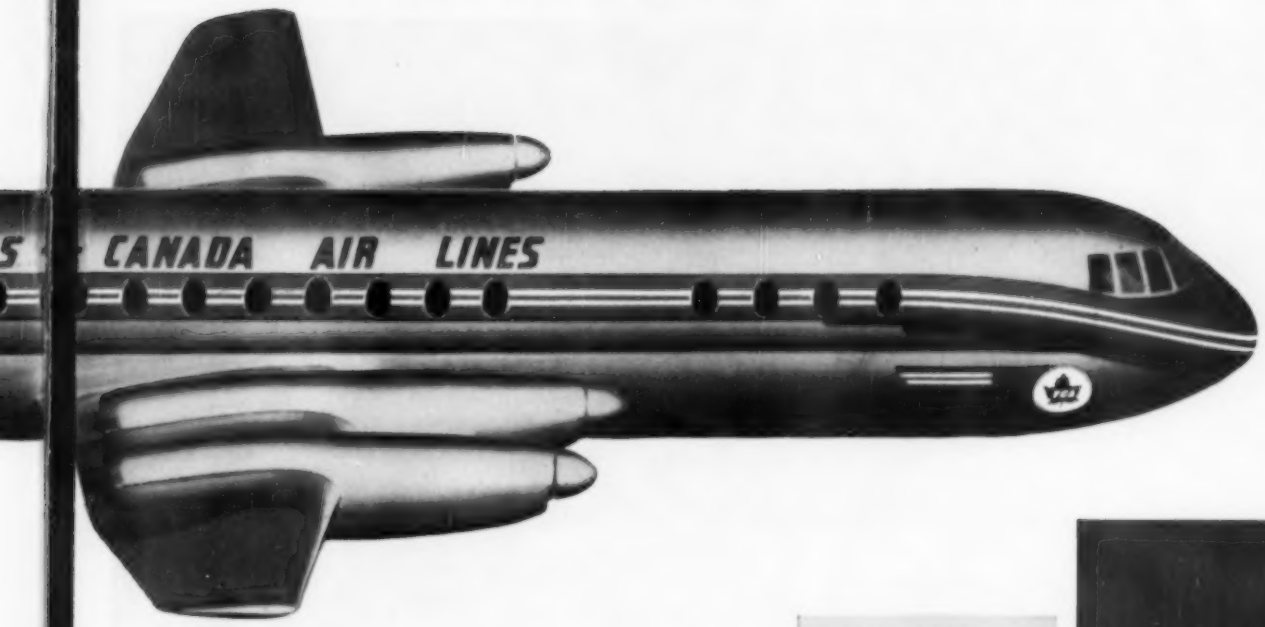
10 TONS OF FREIGHT!

The Vanguard's two huge lower deck cargo holds have a capacity of nearly 1400 cu. ft.—enough to carry 10 tons of freight with no modification in the upper deck!

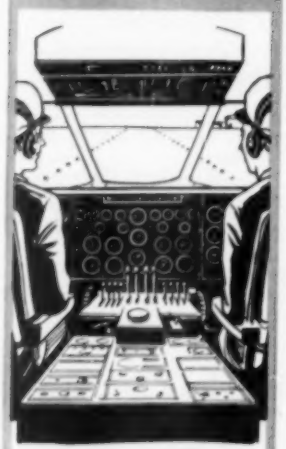
WIDE RANGE OF STAGE LENGTHS!



The Vanguard can be operated economically on short, high-density routes . . . first-class medium hauls . . . or all-cargo services over a wide range of stages. With full payload, the Vanguard has a 2500-mile range.



NO EXTRA-LONG RUNWAYS NEEDED!



The Vanguard offers great flexibility in routing... it can safely use the existing runways of most airports.

The Vanguard's spacious cockpit features simplicity and unsurpassed visibility.

FASTER TURN-AROUND!

Special design features of the Vanguard cut time on the ground—lower operating costs to a minimum. A minimal turning circle of 74 feet, and excellent visibility that enables the pilot to see both outer engines and wing tips, mean the Vanguard can be taken in and out of the most crowded ramps safely and quickly.

Cabin doors fore and aft with built-in folding stairs assure rapid passenger handling. Extra-wide cargo-hold doors at truck level, permit simultaneous loading and unloading. With its low tire pressures, the Vanguard does not have to wait to use a particular part of the apron. All this gives the Vanguard more time where it should be—in the air!

GREATER SPEED, GREATER ECONOMY!

With four powerful Rolls-Royce Tyne jet-prop engines, the new Vanguard will be capable of speeds up to 425 mph. It will have a development potential for even higher speeds.

Years of experience and careful study have proved that for greatest economy over a wide range of stage lengths, the jet-prop is supreme.

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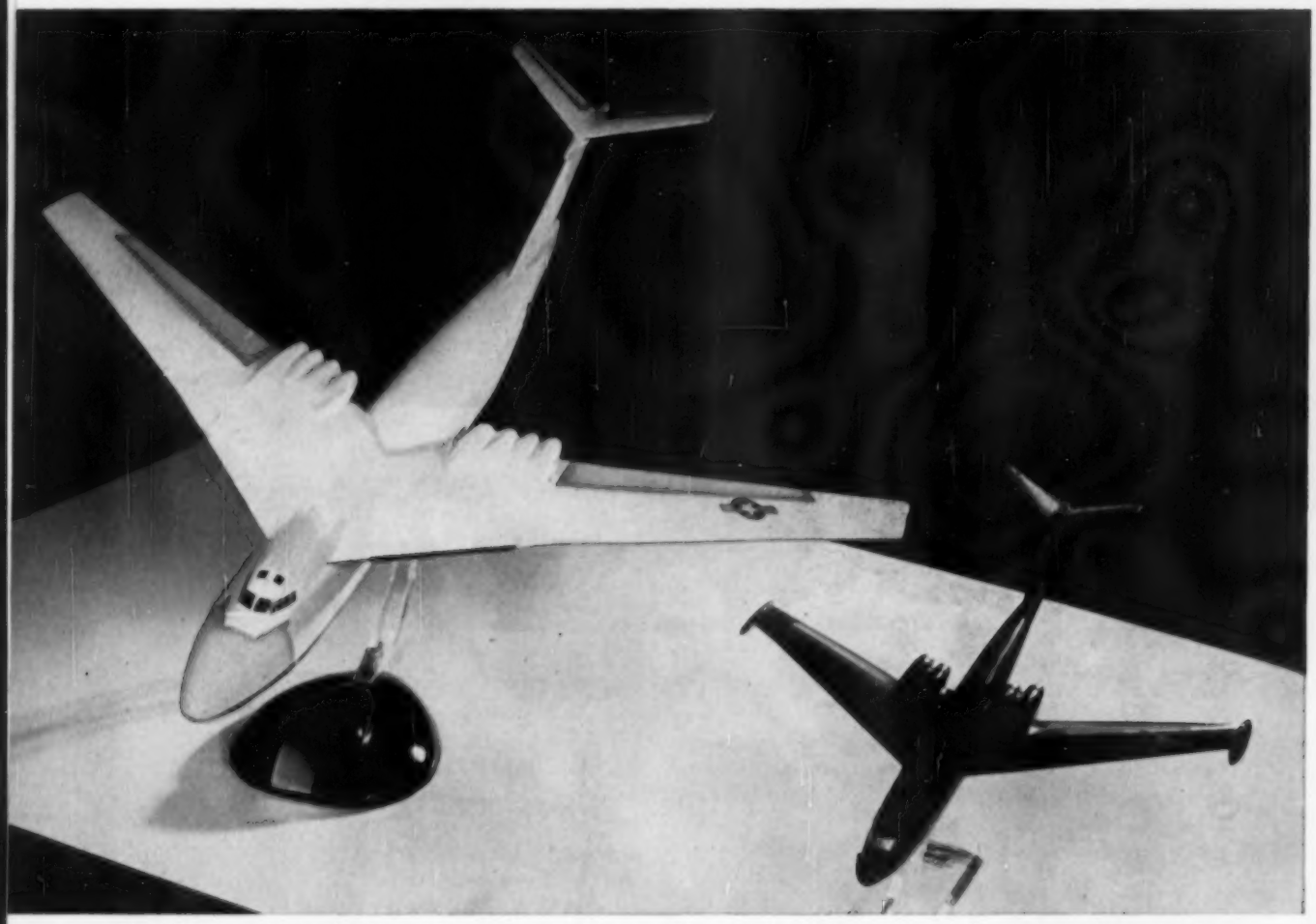


SEAMISTRESS, SeaMaster (right) models in same scale show size, thinner cambered wing, sunken nacelles, area rule of new aircraft. Eight-jet bow-loader is subject of intensive campaign by Martin to sell it as a logistics concept.

Logistic Concept Built On SeaMistress

By Evert Clark

Washington—Martin Co.'s campaign to sell the SeaMistress logistics concept (AW Sept. 2, p. 29) is based on the premises that airlift will be a dominant factor in limited wars, that the services have no modern airlift program at present and that at least part of logistics operations for such wars should be water-based.

Another vital premise in a time of economy is that the SeaMistress could be developed and produced in numbers within existing budget levels if high costs of outmoded logistics methods were scrapped to make way for the giant flying boat.

SeaMistress essentially is an advanced, greatly enlarged version of the P6M SeaMaster, cleaned up with some application of the area rule principle and tailored to a transport mission rather than mine laying or low level bombing tactical work.

Basic idea, however, is larger than simply an aircraft type. After almost five years of study, Martin proposes a complete concept, with SeaMistress as the heart but not the whole of the system.

SeaMistress, although subsonic, incorporates a number of design improvements over SeaMaster, models of the aircraft indicate.

Wing Camber

Wing obviously incorporates more camber than SeaMaster. Eight jet engines are sunk in comparatively thinner wings, greatly reducing drag experienced in bulky SeaMaster design. SeaMaster's thicker wing, large engine nacelles and broadest part of fuselage all occur at approximately the same point in profile, defying the area rule concept, which became known after P6M design was laid down.

Rugged hull demanded by SeaMaster's requirement of high speeds and maneuverability at low altitudes would not be as necessary with the SeaMistress transport.

Large fuselage should give stability and maneuverability in water, and high mounting of engines—22 ft. above water level—would alleviate problem of spray, which easily extinguishes jet engines. Double-stepped bow (see pictures) also is designed to throw spray outward, lessening the chance of water entering intakes.

Elimination of need for SeaMaster's

tail turret allows stern of fuselage to come to a point, increasing stability and maneuverability in water.

Submerged engine intakes in wing and fact that engine nacelles project more below wing than above should improve flow over that of the SeaMaster. Inboard nacelles also are mounted far enough out from fuselage to avoid disadvantages of Coanda effect from exhaust flow.

No Tip Floats

SeaMistress models show no wingtip floats, as on SeaMaster, probably because larger fuselage gives greater stability in water and because wingtips, except in roughest water, would not touch surface.

Martin emphasizes that the SeaMistress can take off and land in 10 ft. waves.

P6M SeaMaster's limits are 6 ft. waves. Company also emphasizes that its logistics concept calls for the SeaMistress to make great use of lakes and inland rivers, where there is no sea-state problem.

Use of fresh inland waters also avoids 95% of marine fouling and corrosion problems associated with seaplanes and greatly decreases loading, unloading and maintenance problems.

In Martin's systems plan, a base consists of a U-shaped dock—now available in prototype form—four or five aircraft, a lake, commercially available floating bins filled with fuel and a Strategic Air Command flyaway kit.

Everything short of major overhaul can be accomplished at these floating bases, which SeaMistress can carry itself and drop at the site before landing, Martin says.

'Rubber Design'

SeaMistress is called a "rubber design," with minimum size approximately twice that of SeaMaster. Powerplants for the first generation would be Pratt & Whitney J75s, the same engines planned for the production version of the P6M. Martin says later ducted fan and nuclear engines can go into the same basic airframe. Depending upon the size and mission, the SeaMistress also could be built in 10-engine configuration.

Gross weight is 200 to 300 tons, again depending upon size and mission capability desired.

Capacity is expressed in a variety of ways—400 to 415 men on a 3,500 mile mission; one company fully equipped, including food for three or four days, for a 500-mi. trip; 50 tons for a 3,500 mi. range or 130 tons for a 1,000 mi. haul, etc.

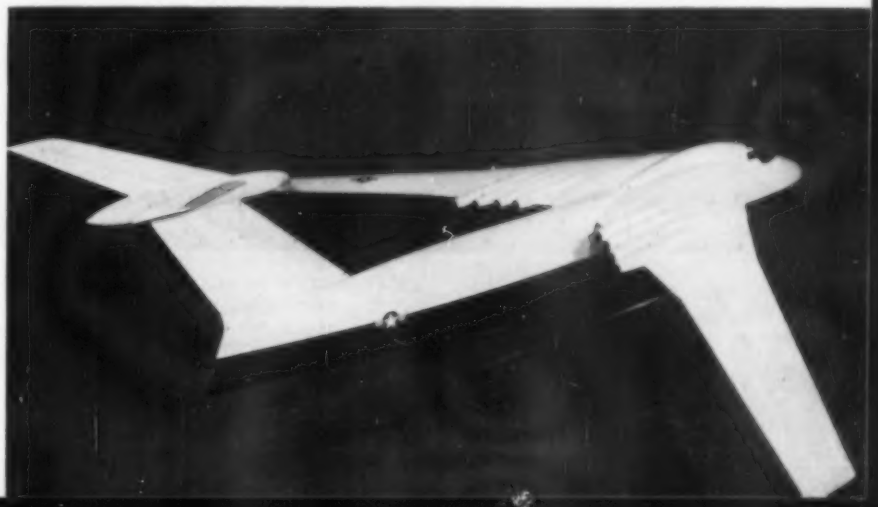
Fueling Plans

SeaMistress could be refueled aerially or by submarine or surface tanker. Based

SEAMISTRESS could take current turbojets, ducted fan jets or nuclear engines.

EXTRA STEP on bow throws spray outward and away from eight jet engine intakes.

SHARP STERN adds more stability, maneuverability, in water than turret-tailed P6M has.



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420 Lexington Avenue, New York, N.Y.

on existing petroleum supplies, Martin believes a fleet of SeaMistresses could run logistic airlines into any of the 43 countries with whom the U. S. has defense commitments if England, Japan and North Africa were available as home ports.

Snow, Ice Landings

Even if these areas were lost to U. S. control, a high percentage of availability of routes to the 43 countries would still exist, based on the idea of using surface tankers that are normally afloat as refueling stations.

In addition to water landing capability, SeaMistress could land in four inches of snow or on thick ice, Martin says.

By means of the technique of parachuting a few men and a 300-hp. compressor, lanes 10,000 ft. long and 300 ft. wide could be cleared in iced-in rivers or lakes at temperatures down to 40F, Martin says. Compressors pump air beneath the ice to circulate warmer layers of water.

Bow Loading

SeaMistress might carry a crew of five plus a cargo crew of five. As much as 130 tons of cargo can be unloaded through the bow door in a matter of minutes if Marine Corps technique of "sea train" unloading is used. Under this concept, cargo carried in floating boxes is shoved out and left for small boats or helicopters to tow onto the shore.

Another possibility is self-propelled lighter rafts.

SeaMistress could be run onto a beach to unload, as the Convair R3Y does. Reversing thrust on just two of the P&W J75 jet engines would give sufficient power to back away, Martin says.

Strategy and politics of the whole airlift question are much less straightforward than engineering and economics of Martin's concept.

Airlift Need

Martin charges that there is an almost undisputed need for military airlift, and no program for meeting the need.

It disputes the argument in some Defense circles that 900 aircraft of the Military Air Transport Service and civilian reserve fleet are adequate to do the job, even if all were available at once—which the company feels is highly unlikely in the event of a Korea or a Suez Canal type of war.

Some of Martin's contentions on large-scale airlift:

• **Present MATS-civil reserve fleet** of 900 planes would require 25 days to move a division into a combat area in the Mideast, minus all but personal equipment, and could operate only if airfields were available. Approximately 100 SeaMistresses could move three

Dust Forms Shock Wave

Unusual cone-shaped shock wave disturbance out ahead of the spherical model above was created by dust particles. This Schlieren photograph was taken at Cornell Aeronautical Laboratory during a study of the effect of atmospheric dust on the re-entry characteristics of various ballistic missile nose cones. The shock wave collapses almost as soon as it is formed. Main object of the study is to determine change in heating rate due to this pulsating disturbance.

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The Model KLF, shown at left, is particularly useful as an exciter for vibration testing equipment and as a variable frequency power supply for a multitude of production and laboratory needs. It will operate *continuously* with an output of 1,000 watts from 6 to 2,000 cps.

Components of all Genisco-Savage Amplifiers are mounted on 19" vertical panels to facilitate easy inspection and maintenance. Quick-release grill covers make all tubes readily accessible from the front. Numerous built-in safety features protect the equipment from operator errors.

Two New Shake Tables Available The new Model V1000 Genisco-Savage Shaker features a very light moving coil assembly, high thrust-to-weight ratio, automatic impedance matching, and an excellent output waveform. A continuous alternating thrust of ±600 lbs. is produced at 1,000 watts control power. Thrust can be increased to ±750 lbs. peak by use of a blower (Model V1000B). Both models have been stress-tested to withstand continuous operation at accelerations of 100 G's.

Seven models—rugged enough for production line testing; versatile enough for almost all laboratory needs.

The Genisco-Savage Model V1000 Shaker

BRIEF SPECIFICATIONS	MODELS						
	BM2	DM2	KM2	10K	KM2S	KLF	KRF
Output	250 w at 50 or 100 v	500 w at 50 or 100 v	1000 w at 50 or 100 v	10,000 w maximum	1000 w at 50 or 100 v	1000 w at 50, 100, or 200 v	1000 w at 25, 50 or 100 v
Frequency Range	50 to 10,000 cps at 250 w	50 to 10,000 cps at 500 w	50 to 10,000 cps at 1000 w	40 to 10,000 cps at 10,000 w	50 to 10,000 cps at 1000 w	6 to 2000 cps at 1000 w	5 to 100 kc at 1000 w
Sensitivity	0.036 v at 600 ohms	0.04 v at 600 ohms	0.1 v at 600 ohms	0.16 v rms at 500 ohms for 10,000 w output	0.1 v at 600 ohms	0.05 v at 600 ohms	0.5 v at 600 ohms
Distortion	1% at 250 w, 1000 cps	0.75% at 500 w, 1000 cps	Less than 0.75% at 1 kw, 1000 cps	Less than 3% at 10 kw, 1000 cps	Less than 0.75% at 1 kw, 1000 cps	Less than 5% at 1 kw, 10 to 1000 cps	

Price and delivery of both amplifiers and shakers are exceptionally good. For complete specifications and prices send for the new four-page illustrated brochure.

Genisco Savage

Genisco, Incorporated
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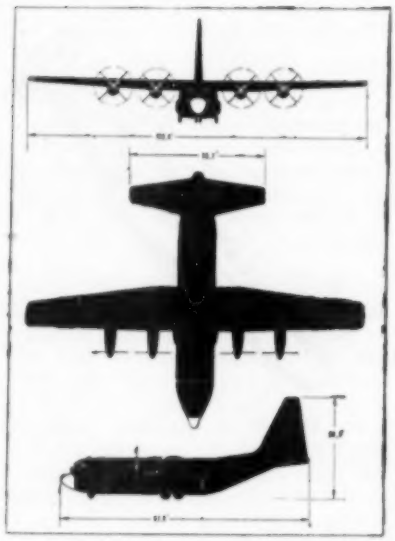


C-130B Three-View

Improved version of Lockheed C-130 Hercules will be offered to cargo lines. Three-view shows dimensions of airplane, which will be designated 282A in commercial model. It will be equipped with 13½ ft. diameter four-bladed propellers instead of three-bladed 15 ft. propeller on C-130A (AW Sept. 2, p. 30).

divisions—including its heaviest equipment—in about 15 days, the company points out.

Ships would require 45 days to transport 3 divisions.

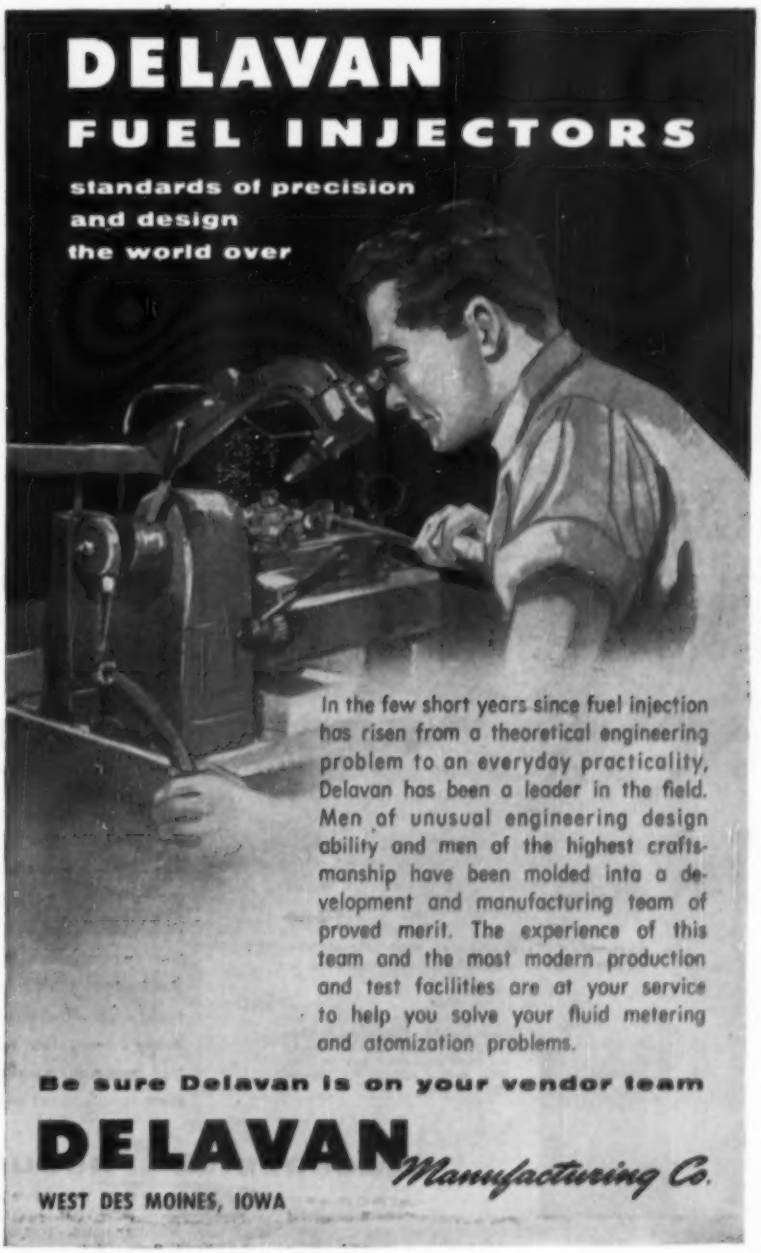
• **Only 9% of combat weight**—men and small equipment—can be moved by the MATS-civil reserve airfleet. The rest needs transports larger than present civil transport aircraft and larger than a medium military transport. SeaMistress, on the other hand, could transport any item of military equipment up to and including Army's atomic cannon, Martin says. As a part of this argument, Martin cites Air Force's lack of large-unit airlift capability. Douglas C-132 program was cancelled entirely and no provision made for procurement of the Douglas C-133 from Fiscal 1958 funds.

• **Availability of bases.** SeaMistress' 8.5-ft. static draft fully loaded means usable water landing areas outnumber land bases that accommodate large transports by 15 to 1. If Martin developed the SeaMistress, it would attempt to reduce draft to six or seven feet, tripling the number of bodies of water available. In discussing base availability, Martin emphasizes that no point in Russia's land mass is more than 50 miles from a usable water area. It says countermeasures present no problem.

Martin said it would take Russia's entire known mine capacity to inactivate the lakes of Poland alone. Also, lakes and rivers could be dragged on a passover and mines could be detonated or, if necessary, bombed out. The company believes water bases are virtually indestructible.

• **Air cover.** Ratio of planes needed to provide air cover over rail, truck and pipelines is five to one over that needed for the SeaMistress system. Providing a cocoon of air cover for 15-30 min./day for each landing area would be sufficient with SeaMistress, and bases would be shifted every two or three days.

• **Savings of large,** fast water-based system. Martin estimates 25% of all troops are in sea transit at any one time, and are therefore useless for combat purposes. In World War II, the company said, some 55,000 men—or about four divisions—were in the transport pipeline each day. It said two-thirds of the goods being shipped to front lines were consumed between the port of entry and the front because of the slow, complex ground logistics system. Martin believes all high-priority personnel and equipment must be moved by air in quick, small wars. It estimates 5% of equipment, 100% of personnel could be handled this way with an air transport fleet of reasonable size. It also believes the MATS-civil reserve airfleet still has a place in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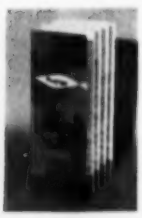

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zone of interior and overseas non-combat area, where airfields are not under attack.

Financing

Martin's belief that development and procurement of an adequate fleet of SeaMistresses can be financed within the current budget levels is based on joint funding by all three services at some later stage, but on initial savings from:

- **The $80 million** which Commerce Department sought and was denied for financing another superliner similar to the U.S. United States. Martin said Commerce plans to ask for $100 million next year to begin construction of a superliner and added: "Development and procurement of four prototype multi-jet seaplane transports with the same funds, however, would result in a troop lift capability as large or greater than that offered by a ship the size of the United States—and with the greater advantages of speed and flexibility."
- **Savings in the pipeline.** The 25,000 troops at sea on almost any day could be reduced to 1,000 a day in an air pipeline.

This would open the way for reducing ground forces and, therefore, the personnel budget.

- **Military Sea Transport Service** now appropriates from $10 million to $15 million annually to maintain passenger transports that are inactive but kept on a ready-alert status, Martin said. These funds could be diverted gradually as a water-based airlift system came into being.

Stumbling Block

Biggest stumbling block to acceptance of such a system is division of responsibility among the services, according to Martin.

USAF has budgetary and mission responsibility for airlift but is wedded to the concept of a land-based transport system.

Navy has development and procurement responsibility for seaplanes but no real logistics mission. Army and Marine Corps not only have a great and immediate need for strategic airlift, which Air Force cannot actually provide, but have shown interest in the water-based concept, Martin says.

Martin's briefings to secretaries and administrative assistants of congressmen will be extended to members of military and appropriations committees in the next session.

Military briefings, which have reached top levels in at least one service, will be extended to high Defense Department levels if possible.

Martin Co. already has conducted SeaMistress briefings for some White House aides, including Brig. Gen. A. J. Goodpaster, staff secretary.

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RELIABILITY

Reliability of the T58 is based on the extraordinary durability its components have demonstrated in over 4000 hours of development testing. Typical results are (1) no catastrophic failures, (2) no compressor or turbine bursts, (3) no trace of combustor deterioration in unofficial Model Tests, (4) no demonstrated effects on compressor life as a result of deliberately induced stalls! Yet, this is just part of the T58's record of ruggedness. In special weather tests, the T58 demonstrated its ability to start in sub-zero temperatures and operate under severe icing conditions.

Rugged development test program, conducted by the Navy's BuAer and General Electric, proves T58 engine is a real "workhorse"—capable of revolutionizing helicopter flight!

GENERAL ELECTRIC T58 ENGINE HAS

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CONTROL STABILITY

To prove the stability of the T58's controls and their responsiveness to a helicopter rotor system, General Electric has subjected the T58 to over 150 hours of tests on this rotor stand. Despite throttle bursts and sudden collective pitch increases, the engine's control system kept power turbine speed loss to as little as 1%! At the same time, the gas generator and power turbine regained efficient operating speeds as fast as 4 seconds! Here, certainly, is proof that the T58 can provide extremely accurate rotor-speed command, more efficient helicopter operation.

POWER SPLITTING

The T58's excellent power-splitting ability makes twin-turbine-powered helicopter flight truly practical. Dual engine runs show the T58's control (1) automatically proportions output of both engines, at any collective pitch setting, (2) allows full military power to be drawn from both engines, (3) holds power differential between engines, at all collective pitch settings, to a minimum, (4) virtually eliminates manual rotor speed adjustment, (5) prevents excessive engine or rotor speeds. General Electric Company, Section 233-8 Schenectady 5, N. Y.

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Runway Rubbish

All the debris shown here, and more —wire, dirt, nuts, bolts, paper, wood, tools. rocks, screws, springs, twigs, and junk ad infinitum — ordinarily collects on airfield ramps and runways within a mere week's time — as it did at the airfield of a major aircraft manufacturer not long ago. These items were picked up laboriously by hand—as they would ordinarily have to be in the case of many aluminum items and flat-surfaced objects not subject to magnetic sweepers. But the high-powered, high-speed Fruehauf Cole-Vac Airfield Vacuum Cleaner gets them all—and, in fact, can clean 1,000,000 square feet of any airfield littered by such debris in 60 minutes.

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Human Factors Group to Hold First Meeting

Human Factors Society of America will hold its first national meeting and constitutional convention at the Mayo Hotel, Tulsa, Okla., on Sept. 25 the day preceding the Human Engineering Conference of the Office of Naval Research at the same location.

The society, which was voted into existence last October, will devote the Tulsa meeting primarily to reports of interim committees, formal organization and other planning.

Aims of the society are to increase and diffuse knowledge of man-machine-environment factors in all its ramifications, pure and applied; to promote mutual interests of investigators of man-machine problems of supporting sciences, designers, manufacturers, and users of products and apparatus of all kinds related to man, and to encourage cooperation among these various agencies.

Communications regarding the society should be addressed to Donald T. Hanifan, secretary, Human Factors Society of America, P. O. Box 24032, Los Angeles 24, Calif.

Other interim officers include:

President Laurence E. Morehouse, University of California, Los Angeles; president-elect John R. Poppen, aeromedical consultant, Northridge, Calif.; vice-president Arnold M. Small, Convair San Diego Division; treasurer Donald W. Conover, Convair San Diego Division, and editor-in-chief Stanley Lippert, Douglas Aircraft Co., Santa Monica, Calif.

Lockheed Creates Unit For Advanced Study

Lockheed Aircraft Corp.'s California Division has created an advanced research unit in a move to develop new business.

At the same time Lockheed will streamline existing programs through a series of engineering branch shifts.

New research unit will evaluate, study and develop aircraft systems concepts prior to preliminary design work, with R. A. Bailey, chief advanced systems research engineer, in charge of the new group.

Company also created two assistant chief engineer posts, assigning them to Arthur Flock and R. L. Thoren.

Four new engineering manager posts were assigned to J. R. Daniell for F-104; H. B. Jansen for P2V antisubmarine and jet trainer projects; A. J. Lechner for WV-2 Navy AEW and models 1049 and 1649 commercial transports, and Lon Storey Jr., Electra transport project.

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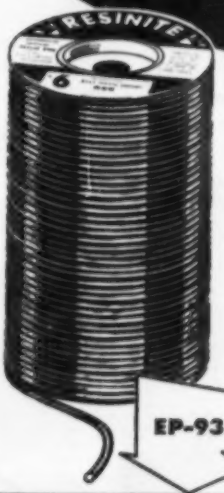

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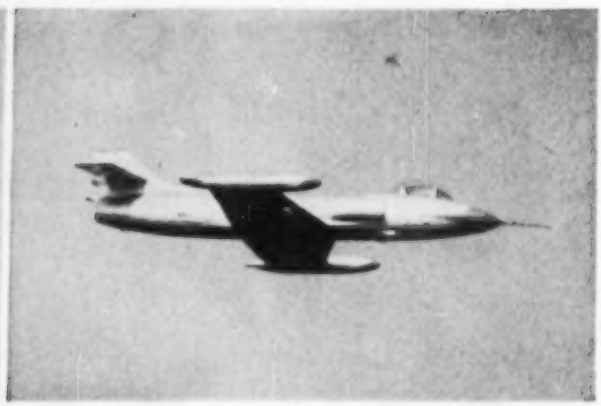
Hawker Hunter, with guns fired out and rocket racks empty, comes in for a landing. Rocket racks are tandem-staggered units developed by Oerlikon and standardized on Swiss fighters.



FFA P.16 is shown after run on target in recent comparative armament trials with the Hawker Hunter F.6. Battery of 24 Oerlikon 8-cm. rockets can be seen under the wings.

Swiss Choice Narrows to Hunter, P.16

Geneva—Choice of a multi-purpose fighter to replace half the aging aircraft of Switzerland's air force now has narrowed down to the Hawker Hunter F.6 and the Swiss FFA P.16.

Outcome of the current series of flight and ground tests should be a recommendation to the Swiss government for the purchase of one of the two aircraft in a quantity of about 200. Government action is expected in the autumn session of the Bundesrat.

But the Swiss have left the door open for further evaluation of foreign types. A special commission was in England for the Farnborough display and will also visit Sweden and the United States to study new developments.

Early Contenders

Earlier contenders for the Swiss order included the Canadair-built North American Sabre 4 and the French Dassault Mystère 4. Both these aircraft have been rejected by the Swiss.

Latest trial in the comparative testing of the Hunter and P.16 occurred last month in armament demonstrations of both planes before the military commission of the Bundesrat. Both planes, armed with a battery of four 30-mm. cannon and underwing Oerlikon 8-cm. rockets—24 on the P.16 and 16 on the Hunter—went through fireout tests at targets in the Lake of Neuchâtel.

Difficulties with the fire-control apparatus prevented the P.16 from releasing its rockets on one run, but otherwise the trials were incident-free.

Sources here claim there is little difference between the two planes on a basis of delivery and operational suitability. They cite advantages for the P.16 in its heavier armament, increased load-carrying capability and approximately 50% more fuel capacity than the Hunter. The P.16 is capable of slower approaches and lower landing speeds, which is an important consideration in operations from the Swiss airstrips. Swiss also say the P.16 is more stable as a gun platform than the Hunter.

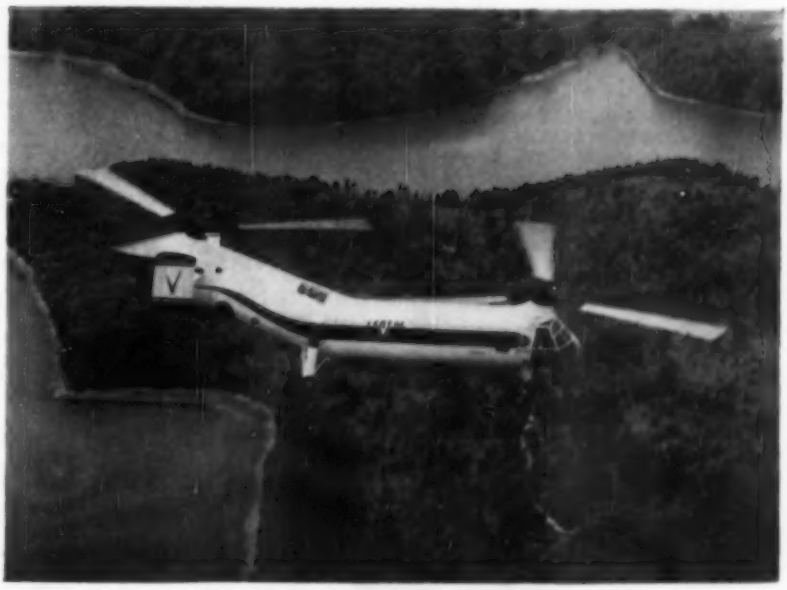
Less Cost

The Hunter is definitely a cheaper airplane, because of its production status compared to that of the P.16. Hundreds of Hunters have been built against a handful of P.16s.

In its F.6 version, the Hawker Hunter is powered by a Rolls-Royce Avon developing more than 10,000 lb. thrust. Gross weight of the Hunter is 17,800 lb.; overload gross is 23,700 lb.

The P.16 prototype was powered by an Armstrong Siddeley Sapphire ASSa.6 rated at 7,900 lb. but recently the engine has been changed for a later model with increased thrust. Gross weight of the P.16 is 20,500 lb. and overload gross is about 25,900 lb.

Present strength of the Swiss air force is about 525 fighters, of which 175 are DH Vampires, 250 are DH Venoms and 100 are North American Mustangs bought from USAF surplus. Mustangs and about 75 of the older Vampires are to be replaced.



Vertol 44 in Sales Tour

Vertol 44 commercial version of the H-21 helicopter, here in flight from Morton, Pa., factory, will be built in civil and industrial versions. V-44A has left for sales tour of offshore oil areas along the Gulf of Mexico to show industrial capability.

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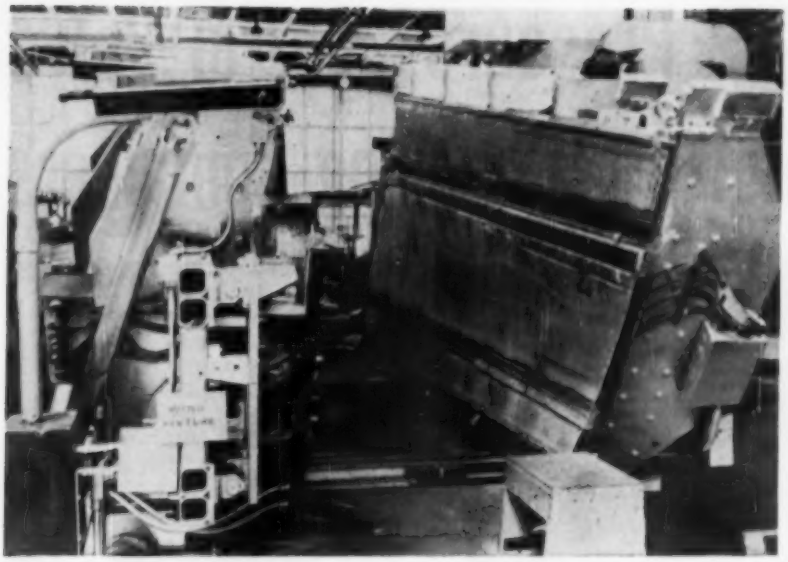

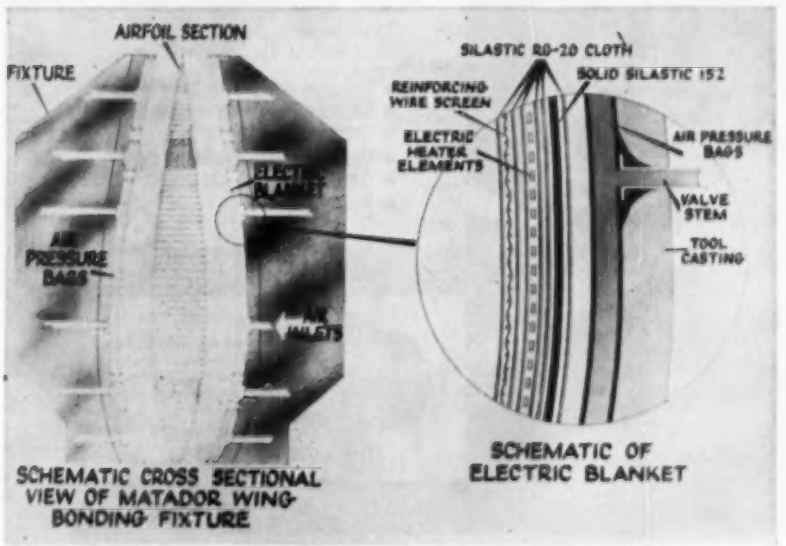

CROSS SECTIONS (bottom) of bonding fixture (top) show how silicone sheet keeps electric blanket heat from deteriorating the rubber pressurizing bag.

Silicone Insulates In Bonding

Dow Corning Corp., Midland, Mich., has supplied the silicone for the fixtures used by The Martin Co., Baltimore, Md., in producing its bonded honeycomb Matador missile airfoil surfaces. Use of silicone for the electric heating blanket and as an insulator between the heating blanket and the rubber pressure bag has permitted Martin to increase the life of the fixture from a few cycles to a 100 parts without replacement of pressure bags or heating blankets.

The 400-1,200 watts per sq. ft. heating blankets are custom made by Safeway Heating Elements, Inc., Middletown, Conn. They are composed of alternate layers of glass cloth reinforced silastic sheets, resistance wire heating strips and copper screening for additional reinforcement and for heat diffusion.

This blanket is insulated from the rubber pressure bag with a $\frac{1}{8}$ in. sheet of solid silastic 152.

In production, the fixture closes in on the wing or tail surface and air pressure swells up between the heating bag and the fixture and forces the skin in upon the honeycomb. Heat is concurrently built up by the blanket to set up the expoxy bonding resin. Martin's present cure cycle is 30 minutes at 310-330F and 15-100 psi. plus preheating and aftercooling cycles to relieve stresses. Complete TM-61 stabilizers can be bonded in as little as 1 hr., 25 min.

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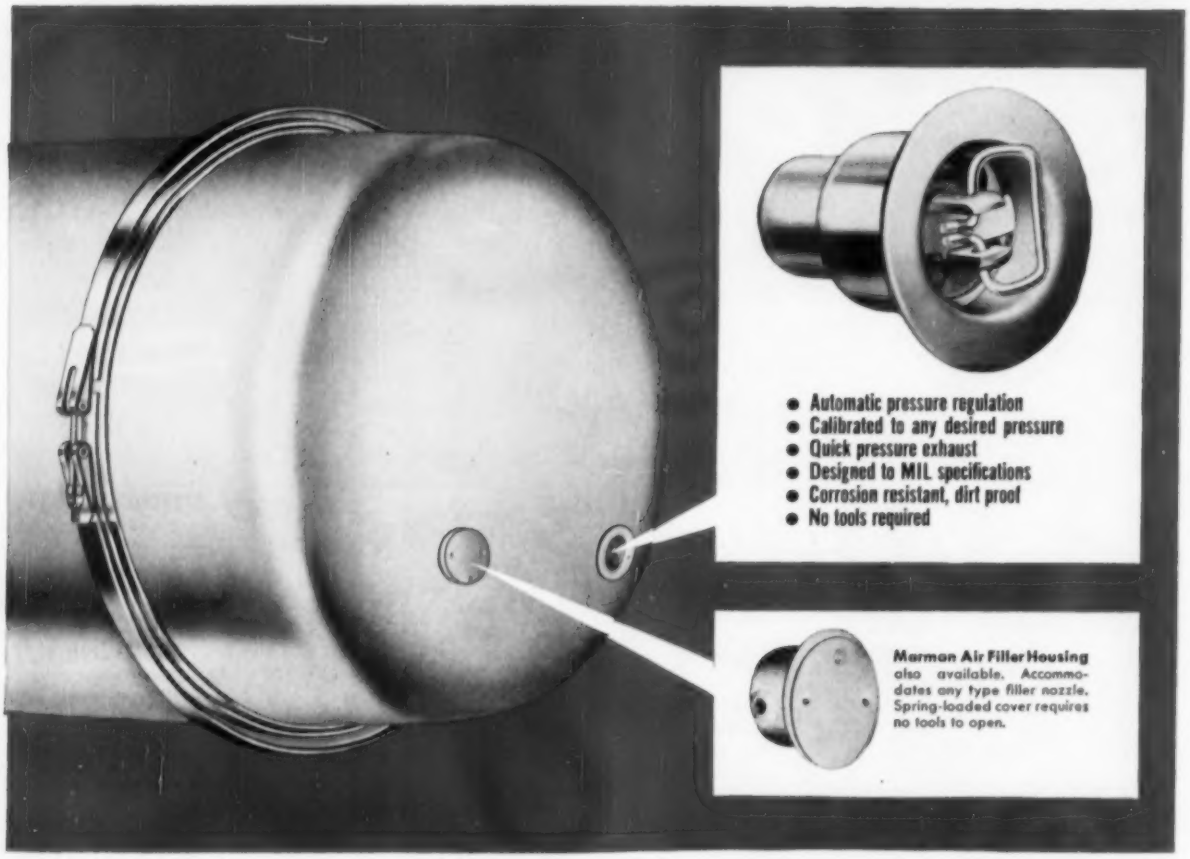
• Automatic pressure regulation
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• No tools required
Marman Air Filler Housing also available. Accommodates any type filler nozzle. Spring-loaded cover requires no tools to open.

The new Marman Pressure Control Valve simplifies pressure regulation and relief in large sealed containers used for storing and shipping military and commercial equipment. Filtered and dried air introduced into the container displaces existing atmosphere through the Marman valve. The valve is calibrated to maintain any desired pressure. Should greater pressure differential occur, the Marman valve relieves back to the maximum desired pressure.

For quick access to the container, the valve provides an air exhaust equivalent to a 1" pipe. Available in standard sizes, for pressures up to 20 psi. Write today for full information.

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Lockheed Aircraft Corp. in conjunction with Anadite, Inc., South Gate, Calif., claims that through vacuum deposition of cadmium on steel parts, hydrogen embrittlement has been completely eliminated. As a result, steel with a 180,000 psi. rating or higher can now be cadmium plated with no danger of hydrogen embrittlement.

Hollywood Heat Treating Co., Los Angeles, Calif., has announced the completion of what it terms the largest heat treating furnace existing in this country available to private industry. The Hollywood furnace measures 8 ft. 3 inches in diameter x 10 ft. deep and will accommodate a retort 4 ft. 7½ inches in diameter x 10 ft. 7 in. deep with an effective working zone of 4 ft.-7½ in. by 9 ft. The furnace will reach a temperature of 2,200F controllable to within five degrees, with a vacuum of 1/10 of one micron. It is now being used to salvage a large quantity of titanium which has suffered hydrogen embrittlement and will be used for degassing advanced materials as well as honeycomb brazing.

Lockheed Missile Systems Division, Lockheed Aircraft, Sunnyvale, Calif., will construct a fourth 51,000 sq. ft. laboratory building at the Division's Palo Alto R&D center. The new lab-

oratory is next to last structure in the building program for the Missile Systems Division's 22-acre site in the Stanford University industrial park.

North American Aviation Inc. will transfer 440 machine tools from two locations to a facility which will specialize in plating, heat treating and accomplish certain types of finish machining. Move involves 550 people, will be done so that no machine is idle more than 24 hrs.

Materials & Controls Corp., Attleboro, Mass., sales for the first half of this year were $19.6 million and earnings were $1.1 million. Compared with the same period in 1956, the sales showed a 13% increase due to the growing volume of the company's nuclear products business for the government. This shift to nuclear work has depressed earnings 16%, according to company officials, because most nuclear contracts are now cost-plus-fixed-fee and permit only a nominal profit. However within the next year the company expects to have its nuclear contracts on a competitive-bid, fixed-price basis.

Instrument Dept., General Electric Co., Lynn, Mass., was awarded a $1.8 million contract for additional MA-1 compass systems. The MA-1 is designed to provide accuracy over portions of the earth as the polar regions where the erratic magnetic field of the earth makes conventional magnetic compasses useless.

Societe Etudes pour la Propulsion par Reaction developed an anti-corrosion liquid for both ferrous and non-ferrous materials. The red colored liquid is a complex combination of phosphates, soluble in a nitric culture.

Solar Aircraft Co., San Diego, received an additional contract for fabrication of brazed stainless steel honeycomb structural sections for Convair's B-58 Hustler.

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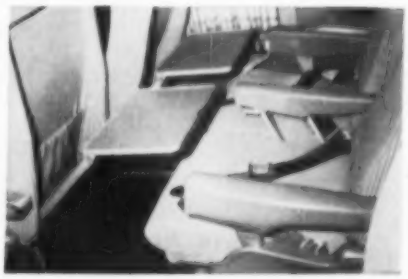

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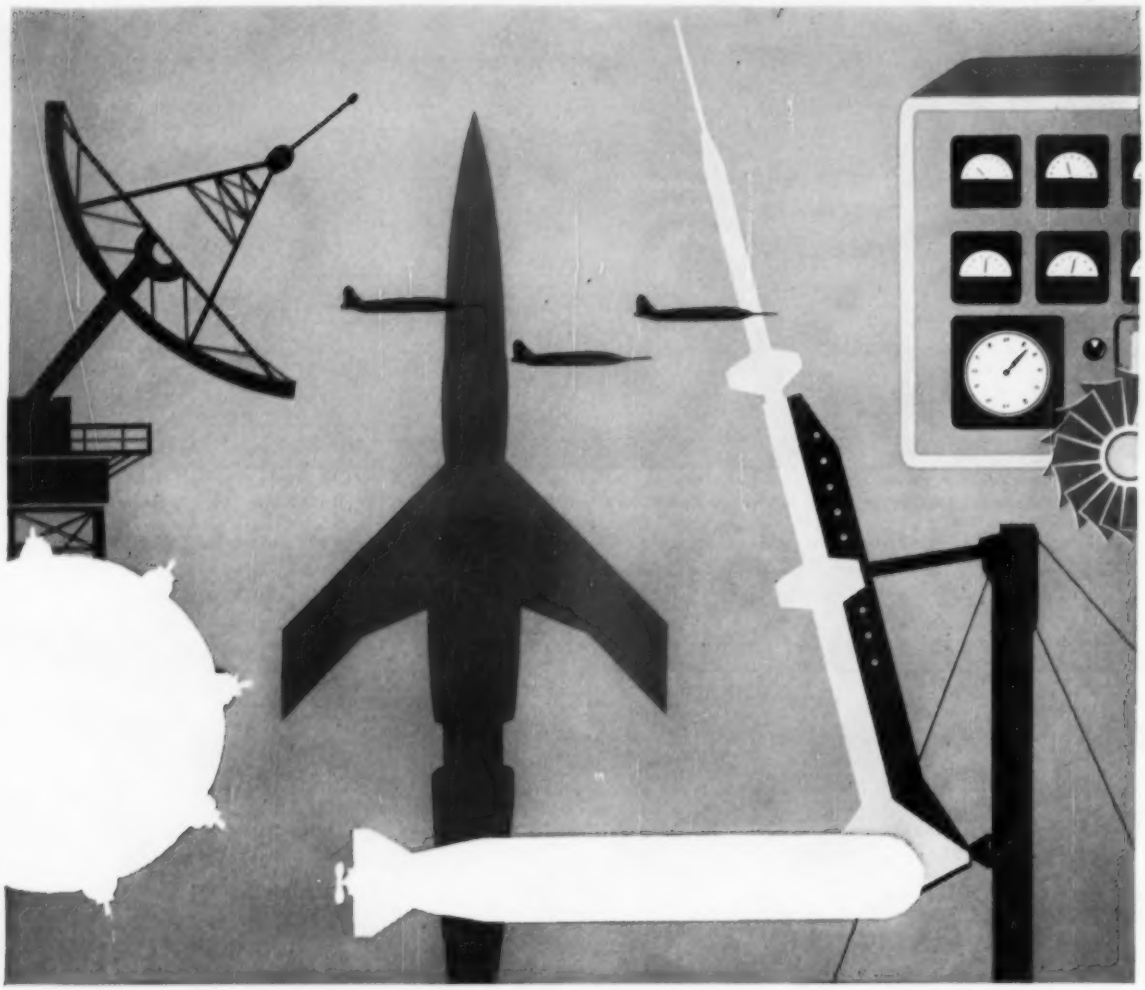
TWO VICKERS SUPERMARINE SCIMITARS, one with wings folded, are parked at catapults on carrier Ark Royal.

Scimitar Carries Out Deck Trials for Royal Navy Aboard Ark Royal

SCIMITAR is stationed in catapult with nose wheel off deck in the position shown (top). It made 148 takeoffs and landings in one day during trials.

DEVELOPED as nuclear-carrying strike fighter for Royal Navy, Scimitar is powered by two Rolls-Royce Avon turbojets.

SUPERCIRCULATION, air tapped from engines and blown over upper surface of flaps, lowers stalling speed for landing.



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Saengers Describe Soviet Missiles

Stuttgart—Two German rocket scientists revealed that the USSR has four long-range surface-to-surface missiles currently in production or development.

Dr. Irene Bredt-Saenger told AVIATION WEEK that she and her husband, Dr. Eugen Saenger, have assembled detailed data on the Russian projects from conversations with scientists on both sides of the Iron Curtain as well as from published material.

According to Dr. Irene Saenger, the Russians have two intermediate range missiles—the T-2 and T-4, also known respectively as the M-103 and M-102—and two intercontinental ones—the T-3, also known as M-104, and T-4A. The T-1 was an early development type.

The recently publicized ICBM which the Russians tested probably is the T-3. According to Dr. Saenger it should go into production by 1960. Its length is 147 ft., launching weight plus booster is 550,000 lb. The engine seems to be driven by a kerosene-liquid oxygen propellant producing a pressure of 425 to 850 lb. sq. in. in the burning chamber. Rated thrust is 275,000 lb. Maximum speed 13,700 mph., range 5,000 mi., maximum altitude 915 mi. The missile is designed to carry a thermonuclear warhead and reportedly has number one priority among Soviet missile projects.

The T-2 missile, is a two-stage missile, according to Dr. Saenger and probably is incorporated in T-3 in component form. Dr. Saenger, says the T-2 first was tested in 1955 and since the beginning of the year has been fired at the rate of one a week. Reportedly the Soviets have a stockpile of 20,000 T-2s.

The head is round, length 98 to 125 ft., body diameter 15.2 ft., launching weight 160,000 to 187,000 lb., rated thrust 77,000 lb. and booster thrust 275,000 lb. Liquid fuel is used, burning time 125 seconds, and propulsion impulse 9,300 sec./tons. Maximum speed is 9,300 mph. and range 1,700 mi. with maximum altitude of 450 mi.

T-2 bases are situated in Kolberg, Poland, Liebau, Memel, Windau, Reval, all in the Baltic states—directed at Scandinavia and West Germany—in Thuringia and East Pomerania—aimed at Italy, and Czechoslovakia—aimed at Germany and Western Europe.

A second Soviet ICBM, T-4A, is under construction and has been tested this year according to Dr. Saenger. It has delta-wings and T-fins. Its length is 59 to 69 ft., launching weight without booster 220,000 lb. Three engines with kerosene-liquid oxygen propellant give the missile an impulse of 27,000 sec./tons. Range is between 4,000 and 10,000 mi. The 2-stage missile will fly Leningrad-New York in 89 minutes.

The fourth Soviet missile, the T-4 is 50 ft. long, has a body diameter of 5.5 ft. and a rated thrust of 77,000 lb. Range is 512 to 1000 mi. This missile is based on the German A-4 and the Soviet T-1 missile.

Both the Saengers have been German rocket researchers over 20 years.

They worked at the Vienna Technical University in 1933 and 1934, got a research order for the development of an intercontinental rocket-bomber at Trauen (North Germany) and worked there until 1942, when Hermann Goering canceled the funds.

Their report on the intercontinental rocket-bomber appeared in 1944. This report was found by the Soviet Army as well as by the U. S. Army.

The Soviets considered the Saengers important enough to send an engineering colonel, Grigori Tokaev, who lives in London now, together with Stalin's son Vasily and the present Soviet secret police boss Ivan Serov to get the Saengers at all costs. The Russians failed.

At present, the Saengers do rocket research at Stuttgart.

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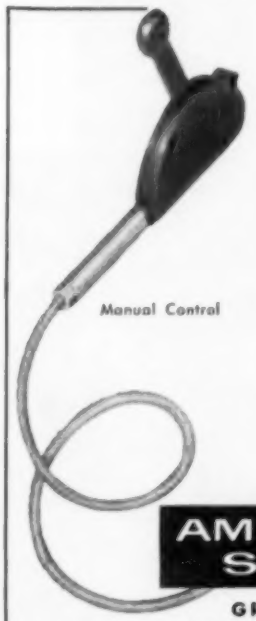

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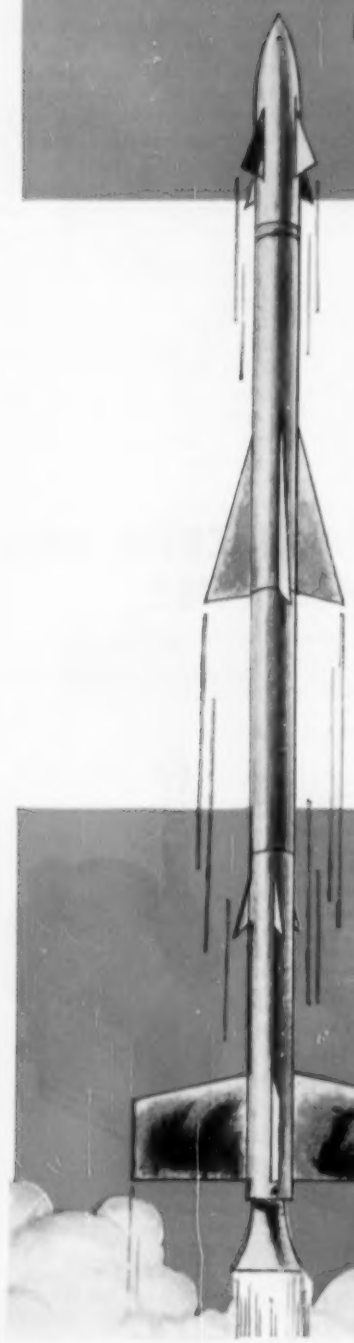

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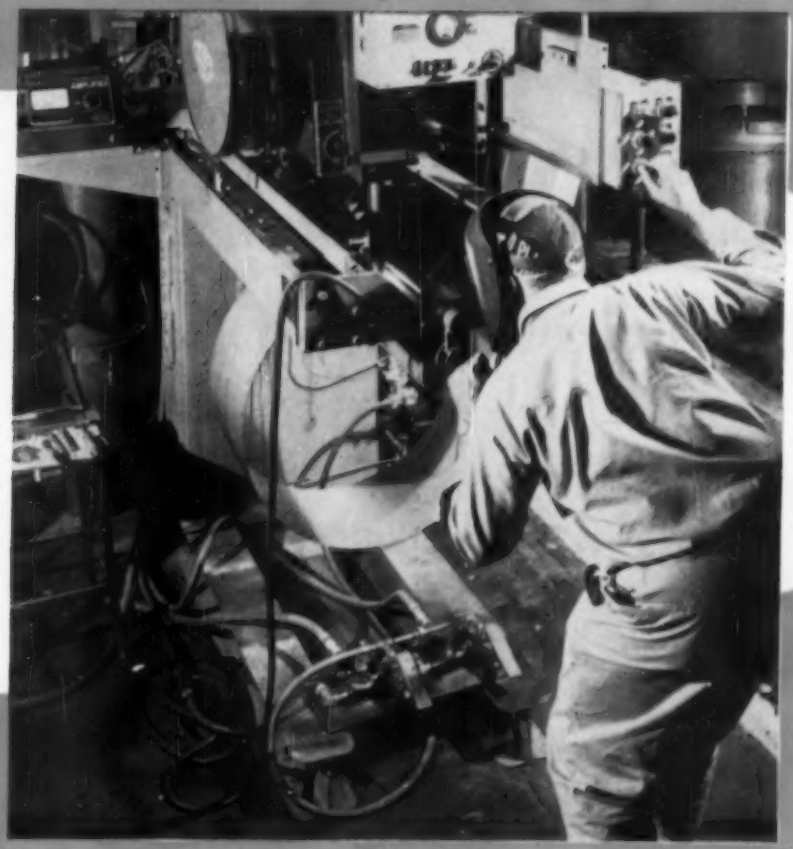

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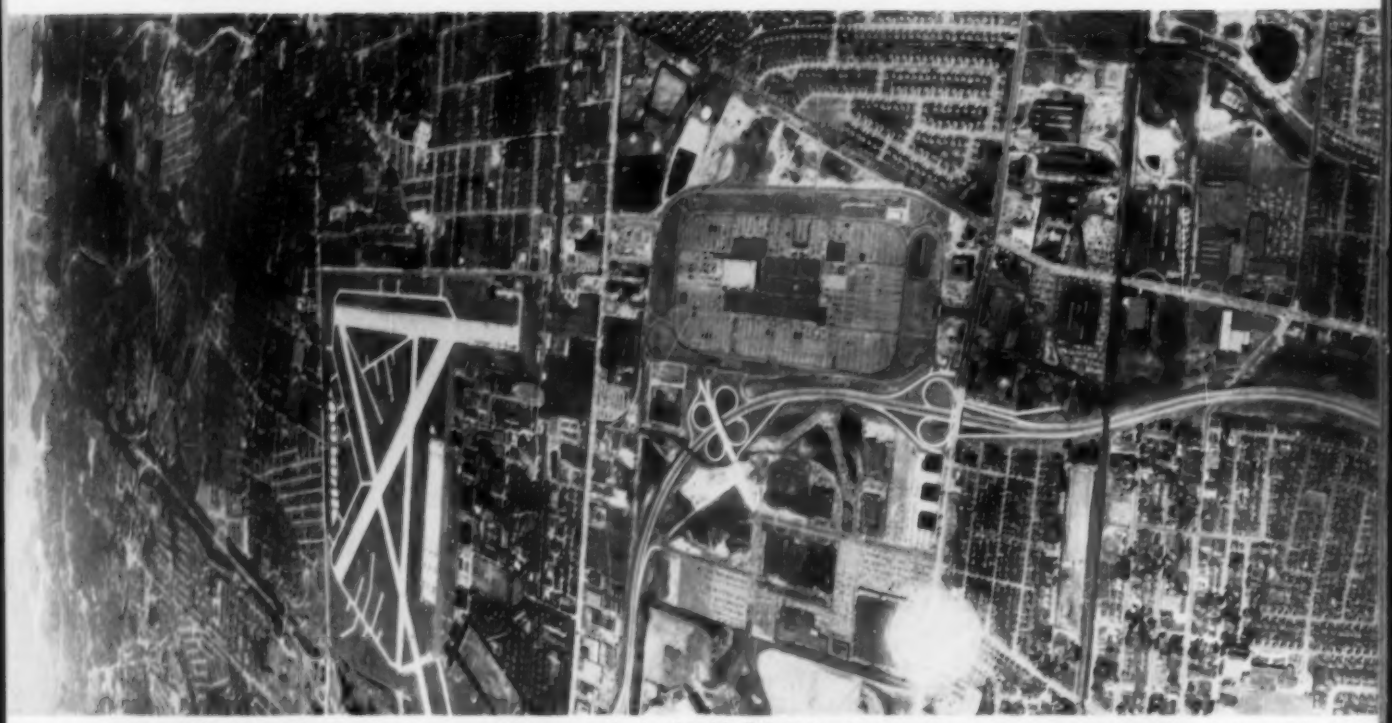


THIS HORIZON-TO-HORIZON photo was taken recently by Model 501 lightweight tracking camera over the middle of Long Island.

Horizon-to-Horizon Camera Is Developed

By George L. Christian

New York—Horizon-to-horizon aerial camera small and light enough to be carried by single-engine fighter-reconnaissance type aircraft has been developed by Perkin-Elmer Corp., Norwalk, Conn. The 180-deg. camera is designed for extremely wide-angle tracking and indexing.

Among its many applications are: aircraft altitude and velocity studies, course monitoring for navigational training, geological surveying, preliminary explorations of unpopulated areas and highway planning.

REVERSE side of the tracking camera shows how the 1,000 ft. of 70mm. film is stored and threaded from one reel to other past scanning dome, rotating prism, mirror.

Camera Size

Called the Model 501 Lightweight Tracking Camera, the device weighs 53 lb. fully loaded, is 7 in. thick, 37¾ in. long and 18½ in. deep. Its 5 in. diameter scanning dome extends 3½ in. below camera's mounting surface.

The Model 501 is a scaled-down version of the 1,500 lb. Transverse Panoramic Camera Perkin-Elmer developed for the Air Force several years ago.

Model 501 uses the scanning-prism technique to wipe an imago onto the film with a continuously-rotating prism instead of using a conventional shutter. The prism, which is corrected for twinning due to the lens power of the scanning dome, is a wedge-compensated

From right to left can be seen: Long Island Sound and Hempstead Bay, Roslyn, Northern State Parkway, Mitchel AFB, Atlantic Ocean.

For Aircraft

double-dove type equipped with masks to assure uniform exposure of the horizons. Prism and film drives must be absolutely uniform to insure precise reproduction of the microscopic detail required in aerial photography.

Other features of the camera's operation include:

• **Suitability** for both flat and stereo photography. When set to take overlapping pictures, good stereo effects may be obtained.

• **Provision of good resolution**—40 lines/mm. on high-speed film can be obtained in spite of the ultra-wide scanning principle used.

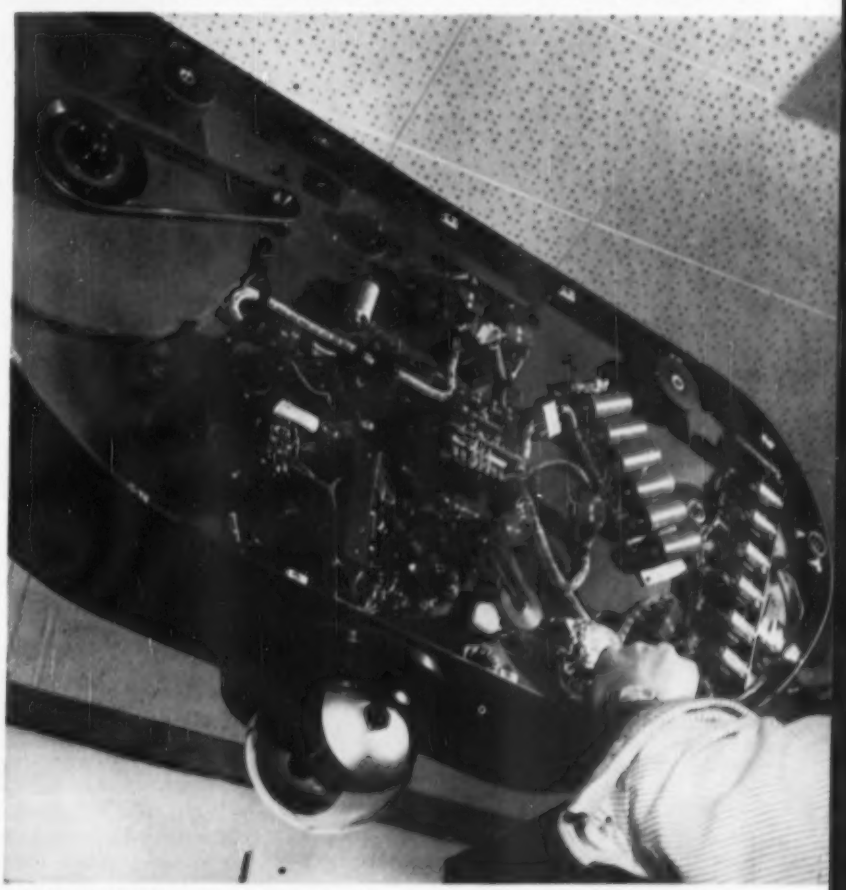
Model 501 may be pre-set for completely automatic operation, or it may be operated manually from a recessed control panel on the camera itself. Provision is also made for starting and stopping the unit remotely from the cockpit.

Completely Self-Contained

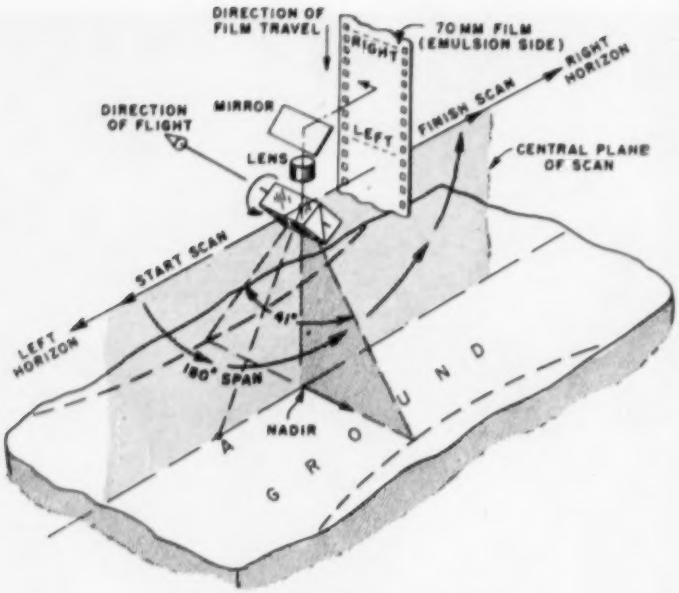
The panoramic tracking camera is a completely self-contained package. Within its cabinet is housed:

• **Reel for 1,000 ft.** of 70 mm. film, enough for a long reconnaissance mission since the camera uses about 10¼ in. per exposure.

• **Image motion compensation** (IMC) which synchronizes movement of film with plane's speed over terrain to freeze



PERKIN-ELMER'S tracking camera showing operating mechanism, scanning dome.



SCHEMATIC of Model 501's optical system.

motion and provide razor-sharp pictures.

• **Automatic intervalometer** to provide the desired exposure interval and overlap.

• **Automatic exposure control** to assure correct film exposure although the wide-angle lens has a fixed F.6.3 opening. This is accomplished with a servo slit system which automatically corrects exposure to match overall ambient illumination. Photovoltaic cells in the dome on either side of the prism provide slit control impulses through a relay-servo and follow-up system. Different film speeds are taken care of by a six-position range switch.

• **Automatic data recording**—A system which projects data pertinent to the exposure directly on the image for correlation purposes.

• **Fail-safe operation** which includes built-in features to prevent damage to equipment in the event of power failure, faulty film or other difficulties.

Optical system includes:

• **Objective**—3 in. F. 6.3 orthometar type fixed focus type.

• **Mirror**—Front surface reverting, graded coating for uniform field illumination.

• **Filters**—Three aero filters: red, minus-blue, clear.

• **Dome**—Hyperhemispheric dome, precision ground and polished.

• **Format**—Angular coverage 42 deg. X 180 deg. Picture size is 2.375 X 9.425 in.

For a camera installation where the plane of scan is at right angles to the direction of flight, the photographic image would be blurred were IMC not provided to compensate for the velocity of the aircraft. IMC mechanism axially displaces the focal plane rollers over which the 70-mm. film travels during exposure. Displacement is in a direction to cancel image movement, is synchronized with the scanning prism, and is correlated to the speed and altitude of the aircraft.

Scan time is adjustable and can be set as fast as ¼ sec.

Self-contained constant-speed intervalometer provides exposure intervals from 2-64 secs.

Overlapping to 60% is possible.

Since the camera repeatedly scans across, rather than along a plane's flight path, it records a continuous scene.

Film movement is intermittent while prism rotation is continuous.

OFF THE LINE

New plant was recently built by Stratoflex at Fort Wayne, Ind., to help expedite deliveries of flexible hose assemblies and fittings to the East Coast

and Middle West. The 15,000 sq. ft. facility is fully equipped to manufacture the Stratoflex line of products used in aircraft and industrial fuel, oil, hydraulic and pneumatic systems.

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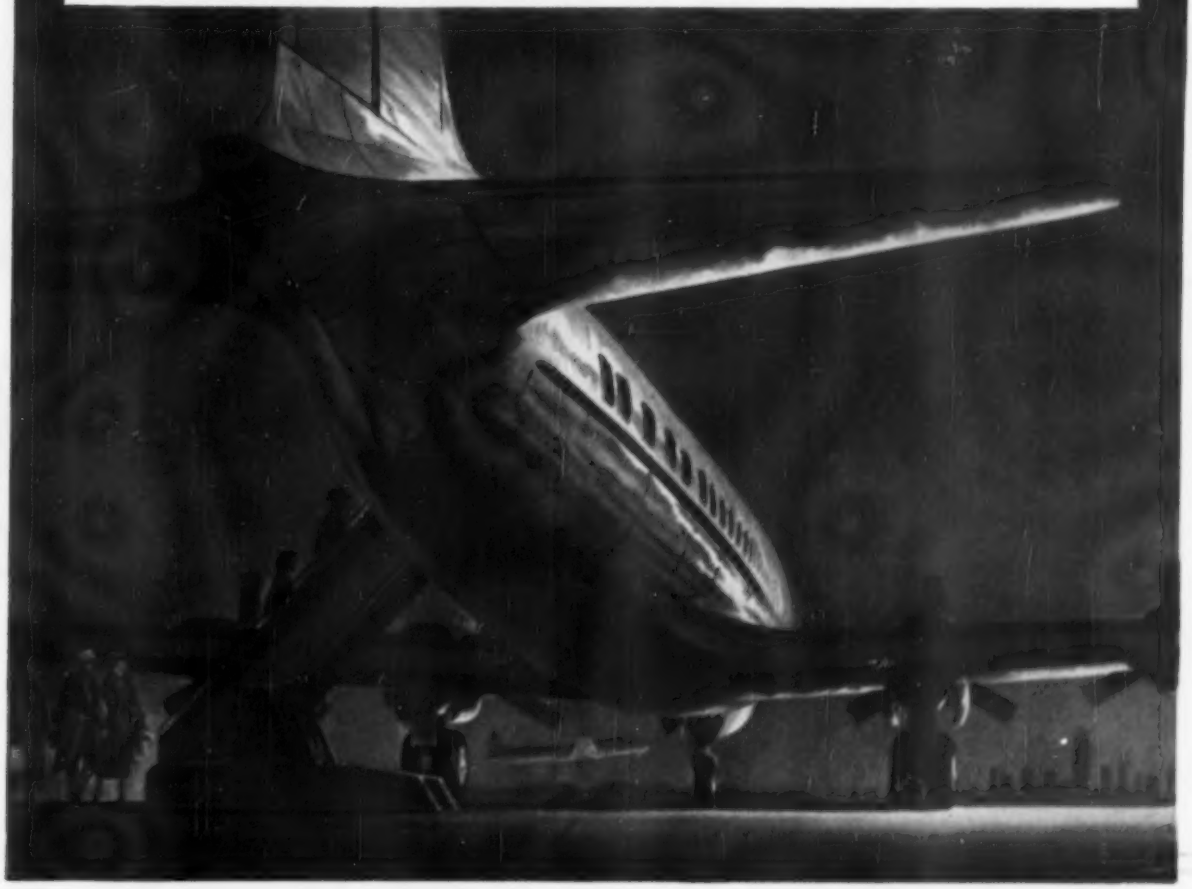

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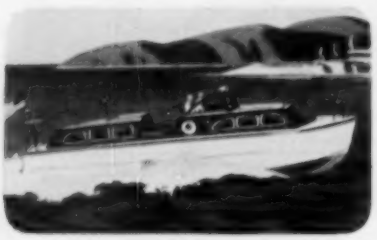
Missile Applications

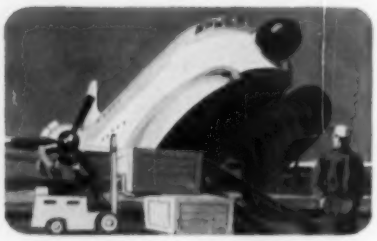
Ground Support for Jet Aircraft

Portable Power Generation

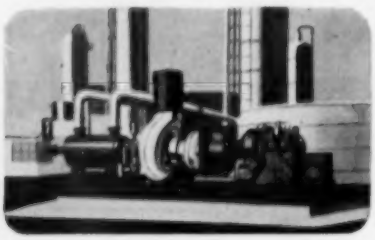


Small Boat Propulsion

Portable Fire Pumps



Auxiliary Power for Aircraft



Turbine Drives for Process Pumps

Power for One-Man Helicopters

Emergency Stand-by Power

Here are nine Solar gas turbine uses! Can you think of more?

SMALL-SIZE SOLAR GAS TURBINES offer a radical new power concept for forward-looking businesses. Their easy portability, high power-to-weight ratio and reliability make them ideally suited for applications beyond the scope of conventional engines. They are easy to maintain, start instantly after long periods of inactivity and can burn a wide variety of fuels—including gasoline, kerosene, diesel oil and others.

Shown above are only nine of the many uses for these new prime movers—and additional applications are limited only by the imagination. To date more than 1000 Solar gas turbines have been sold. They are serving 35 different customers in more than 50 applications. Current production models—the 50 hp Mars® and 500 hp Jupiter®—are being turned out in volume for a growing list of satisfied military and commercial users. And development work on a new 1000 hp Saturn engine is going forward.

For more than a decade Solar has been making important contributions in the gas turbine field. Whatever your business, whatever your special power needs, perhaps a versatile Solar gas turbine can provide the answer. For a new gas turbine brochure, write to Dept. D-83, Solar Aircraft Company, San Diego 12, California. *Designers, developers and manufacturers of gas turbines, expansion joints and aircraft engine, airframe and missile components.*

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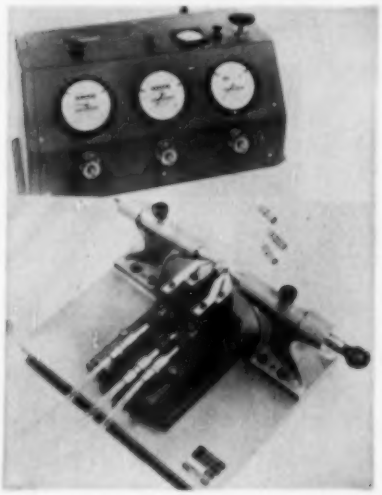


other. All three readings are indicated simultaneously on a triple-unit air gage indicator. Dials on gages are graduated to 20 millionths of an inch.

Federal Products Corp., 1144 Eddy St., Providence, R. I.

Avionic Heat Exchanger

Model RR20090 airborne electronic heat exchanger has nominal heat dissipation rate of 6,000 w. total for both fluid circuits while maintaining maximum liquid outlet temperature of 180F from sea level to 20,000 ft. Maximum cooling air temperatures at this performance rating are 131F at sea level and 118F at 20,000 ft.

Weight is 50 lb. dry.

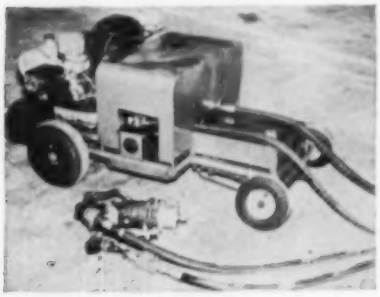
Lear-Romec Division, Lear, Inc., Elyria, Ohio.

Salt Bath Cleaner

Molten salt bath cleaner and descaler for aircraft parts reconditioning can

be engineered for either straight oxidizing or electrolytic bath; unit illustrated is an oxidizing salt bath installation.

Kolene Corp., 12890 Westwood Ave., Detroit 23, Mich.

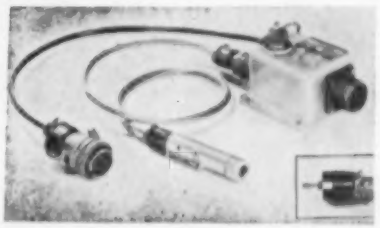


Jet Engine Starter

Hydraulic ground-mobile jet engine starter has been demonstrated to start the Allison 501-D4 turboprop in 40 sec.; the P&WA J57 in 31 sec. In both cases prime mover horsepower needed was only about one-third used by other systems for similar powerplants, the manufacturer reports.

Unit shown is fitted with a 70-hp. lightweight aircooled gasoline engine, installations with engines from 50 hp. to 250 hp. are available.

Vickers, Inc., Detroit 32, Mich.

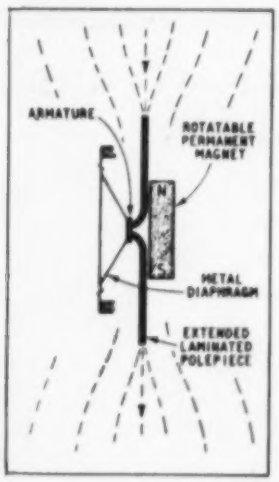


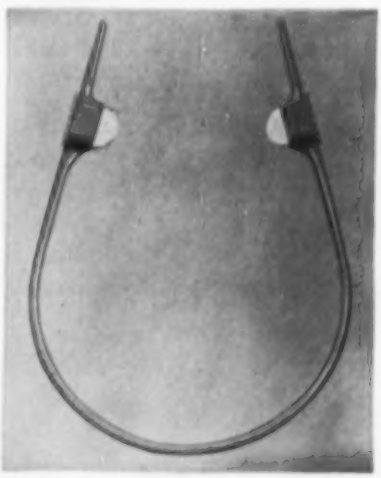
Camera Exposure System

Automatic exposure control system for still aerial and motion picture camera provides three operating ranges each spanning three adjacent f. stops. Desired range is manually preset in relation to prevailing light and film speed, lens opening is then automatically controlled within selected stops.

Power requirements are 1¼ amp. at 24 v.d.c. Environmental specifications comply with MIL-C-6662a ffom −65F to 160F.

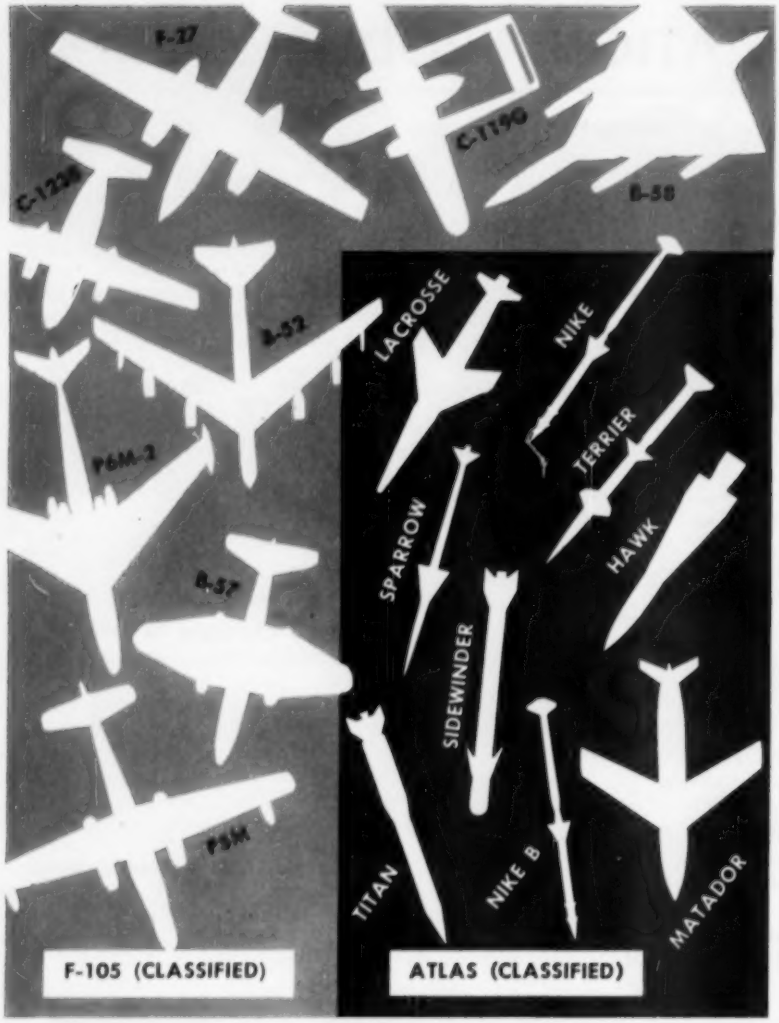
J. A. Maurer, Inc., 37-01 31st St., Long Island City, N. Y.





Wireless Headset

Wireless headset using electromagnetic induction principle can be used by running several loops of wire around an area, hooking the ends to any radio, tape recorder or microphone amplifier and operating with the headset within or near the loop. Wires are not connected to head gear. Hearing-aid type headset weighs 1.5 oz. British have wired the deck of carrier HMS Bulwark to use the system. Meteor Air Transport, Inc., plans to test the installation in a DC-4 to decide the optimum loop location in a transport-type airplane. Magnetic Induction Systems, Inc., 130 Harrison St., Hoboken, N. J.



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WHAT'S NEW

Publications Received:

ADF Stations—Pub. Learcal Division of Lear, Inc., 3171 South Bundy Drive, Santa Monica, California, $1.00; 80 pp.

A list of pertinent data with more than 3000 radio stations suitable for automatic direction finding in the United States, Canada and Mexico.

Low Level Mission—by Leon Wolff—Pub. Doubleday & Company, Inc., 575 Madison Avenue, New York 22, New York. $4.50; 240 pp.

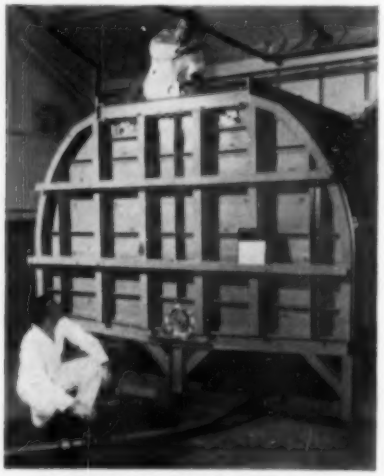
The complete story of the low-level AAF bombing of the oil refineries at Ploesti, Rumania, on August 1, 1943.

Glass Reinforced Plastics—Edited by Phillip Morgan—Pub. Philosophical Library Inc., 15 East 40th St, New York 16, New York. $15.00; 276 pp.

The main object of this book is to present the facts on the raw materials, i.e. the resins and glass, to describe the fabrication techniques now in use and to discuss some of the problems of specialized applications.

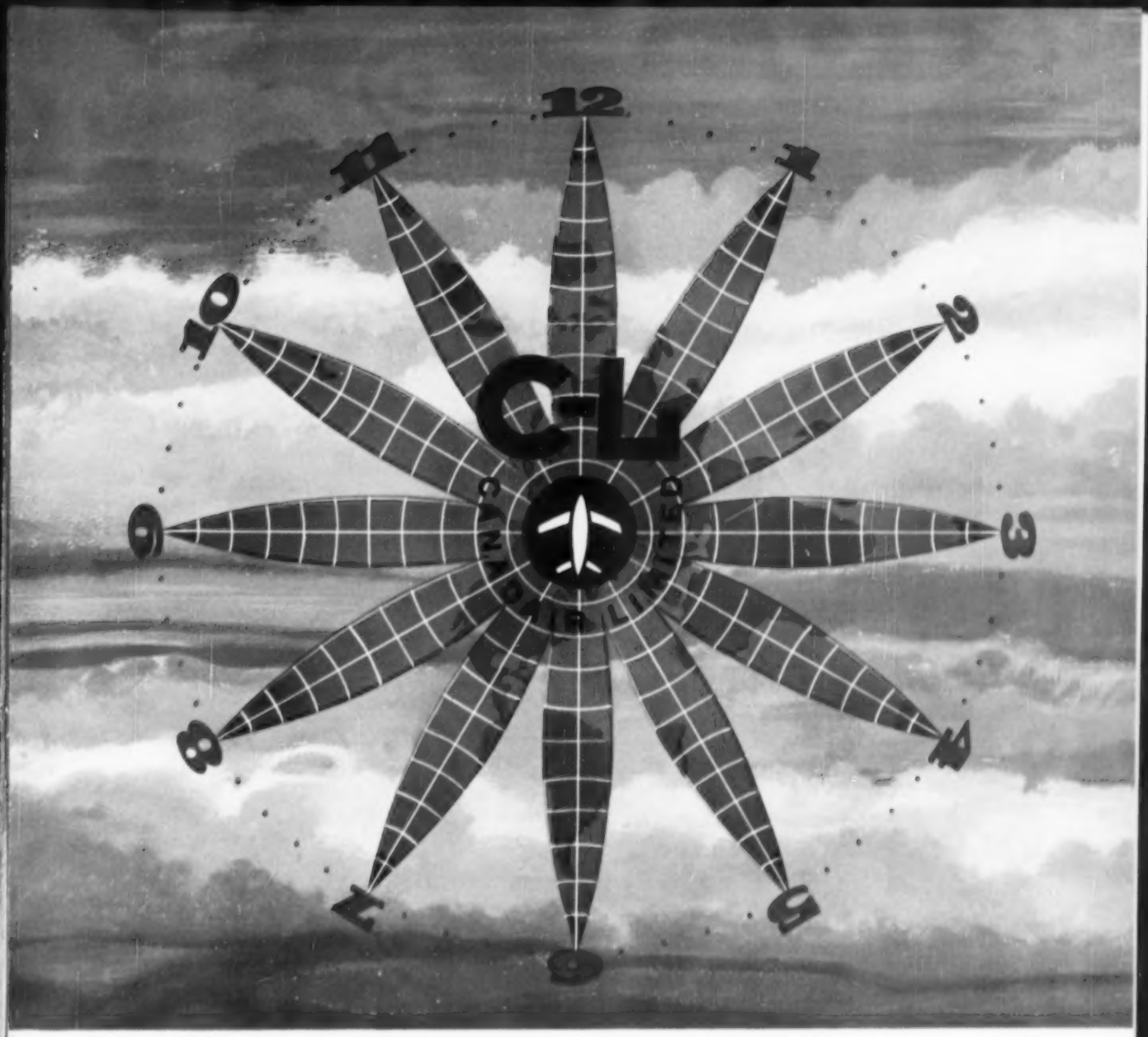
Electronic Components Handbook—Prepared for Electronic Components Laboratory, Wright Air Development Center, and edited by Keith Henney and Craig Walsh—Pub. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, New York. $9.00; 224 pp.

This book furnishes data on resistors, capacitors, relays and switches as an aid in selecting and applying the best unit



B-52 Fuel Cell Test

This large B-52 fuselage fuel cell is being checked for leaks at Goodyear Tire & Rubber Company's Testing Station at Wingfoot Lake, near Akron, O. The filled cell will stand for 30 days. Any leaks will show on the specially-lined cavity walls.



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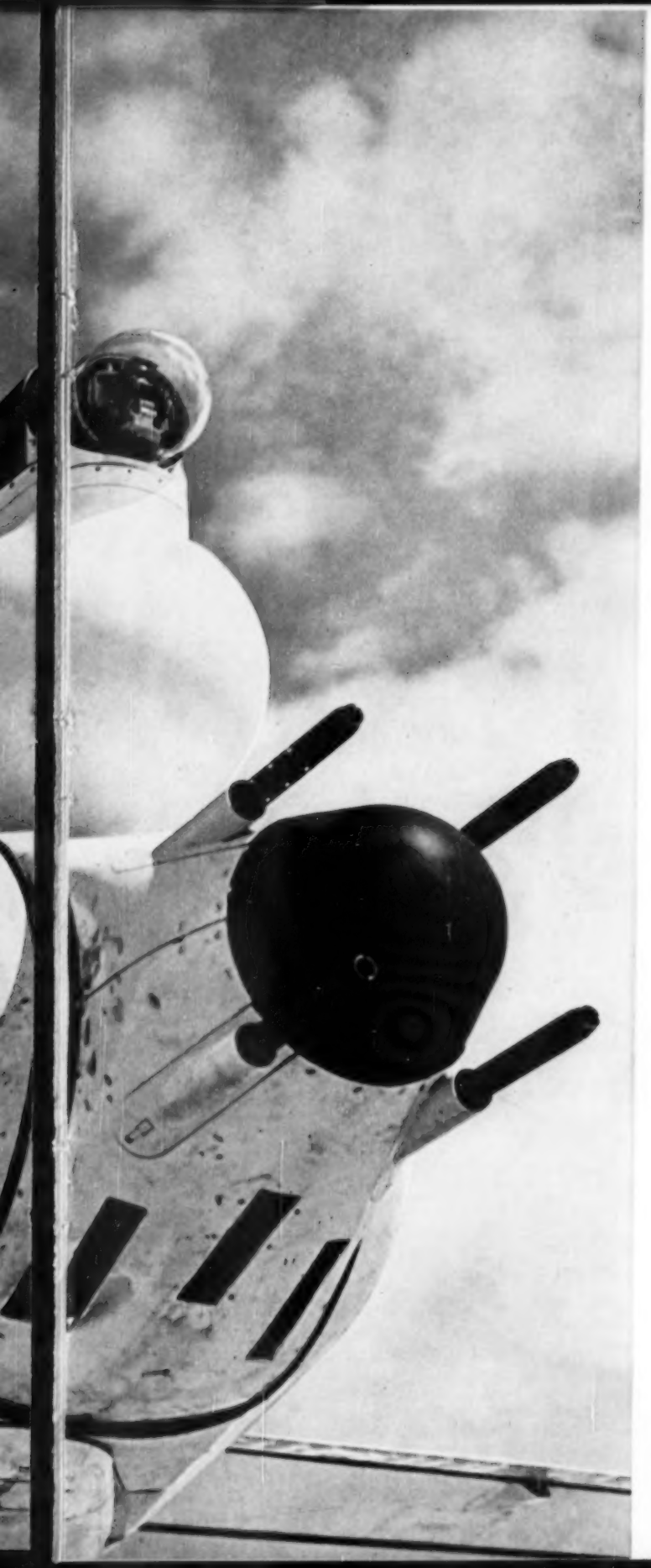

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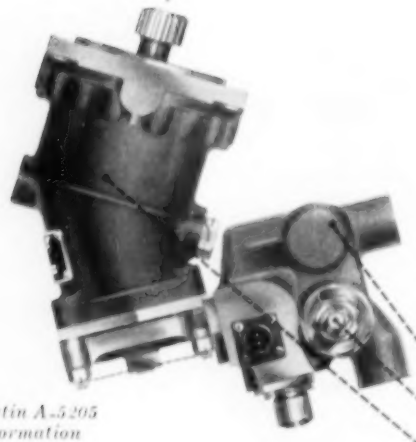
The giant "saucer", rotating atop this Lockheed Super Constellation, contains an airborne radar antenna. It requires a high-power-to-weight ratio driving mechanism for the scanning operation. This mechanism must be compact, dependable, able to provide constant speed, regardless of load change . . . and operate in a position remote from the aircraft power supply.

The small (approximately 13 pounds) VICKERS PACKAGE DRIVE more than meets the drive requirements of the large (30 feet diameter) radome. And – like similar Vickers hydraulic components used in the Constellation for other purposes – provides proven dependability spanning many years of aircraft applications.



Write for Bulletin A-5205 for further information about the motor.

Drive components include:

- Modulating flow control valve maintains selected constant speed, regardless of load change.
- Slide valve for selection of motor rotation direction and speed.
- Fixed displacement hydraulic motor for driving the radome.

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for a particular job so that the maximum reliability of the end product results.

Elements of Gas Dynamics—by H. W. Liepman and A. Roshko—Pub. John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, New York. $11.00.

This work emphasizes fundamentals dealing with the essentials of thermodynamics, gas dynamics, basic equations of motion, high speed aerodynamics, viscous flow and experimental methods.

Reports Available:

The following reports were sponsored by the Office of Technical Services, United States Department of Commerce, Washington 25, D. C.

A Large Barium-Titanate Accelerometer for Shock-Velocity Measurements—by T. A. Perls and C. W. Kissinger, National Bureau of Standards; $.50; 19pp.; (P.B. 121584).

Creep Buckling of Integrally Stiffened Aluminum Alloy Panels—by C. W. King, North American Aviation, Inc., for Wright Air Development Center: $1.75; 80pp. (P.B. 121466).

Survey of Low-Alloy Aircraft Steels Heat Treated to High Strength Levels: Part 3—Failure Causes:—by G. Sachs, Syracuse University for Wright Air Development Center: $2.00; 80pp. (P.B. 121667).

Effects of Specimen Preparation on Fatigue—by F. H. Vitovec and H. F. Binder, University of Minnesota for Wright Air Development Center: $1.50; 53pp.; (P.B. 121576).

How to Select an Air Compressor of the Right Size and Type—Pub. by, and available from, The Air Compressor Research Council, 27 East Monroe, Chicago 3, Illinois. $.50, 11pp.

Abilities to Fit the Job—Pub. by, and available from, The Engineering Department, American Mutual Liability Insurance Company, 142 Berkeley Street, Boston 17, Mass. $2.50; 145pp.

ASTM Standards on Petroleum Products and Lubricants (With Related Information)—Pub. by, and available from, The American Society for Testing Materials, 916 Race Street, Philadelphia 3, Pa. $7.50 cloth covered, $6.75 paper covered; 1096pp.

Testing of Weighing Equipment—by Ralph W. Smith, available from National Bureau of Standards, U. S. Department of Commerce, Washington 25, D. C. $1.25; 184pp.

Regenerative Cooling of Rocket Engines

by William H. Kaechele

A research physicist in the Physics Department, Component Development Division, Reaction Motors, Inc., Mr. Kaechele has been investigating the complex mechanism of heat transfer as applied to the cooling of rocket engines. Prior to his affiliation with RMI in June, 1956, he was employed in pressure instrumentation research for the National Bureau of Standards. Mr. Kaechele is a graduate of American University (B.S. in Physics).

A high performance liquid propellant rocket engine using conventional fuels operates at chamber temperatures of 4000°F. to 8000°F. and pressures generally in the range of 300 to 600 psi. Since no known, practical material retains its strength under these conditions, most liquid rocket engines are cooled by one of several means: film cooling, transpiration, or—most commonly in engines with flight applications—regenerative cooling. Regenerative cooling is accomplished by flowing either fuel or oxidizer—or more rarely, both—through passages in or around the thrust chamber before injection. This flow cools the chamber walls and, as an incidental benefit, may increase engine efficiency about 1% as a result of increasing, by heating, the initial energy content of the fluid.

Combustion temperatures are high; therefore the cooling fluid must remove heat at a very high rate. In the traditional power industry the required heat transfer rates rarely exceed 2000 BTU per sq. ft. per hour, as contrasted with over 5,000,000 BTU per sq. ft. per hour commonly encountered in the rocket industry. For convenience, the rocket engineer uses the unit BTU per sq. inch per second and deals in heat flux rates of 1 to 20 BTU per sq. inch per second.

As the amount of heat transferred into a fluid is increased, the mechanism of heat transfer goes through several distinct phases. At low heat rates and small differences in temperature between the fluid and the wall, heat is transferred by conduction into the moving fluid and by convection of the heated layer. Heat rates at these low temperature differences may be in the order of 0.01 BTU per sq. inch per second. At slightly larger temperature differences (ΔT), local boiling on the wall commences. Vapor bubbles form and are swept away into the bulk of the fluid and absorbed by condensation. With this type of transfer, called nucleate boiling, heat rates become very large—in the order of 1-20 BTU per sq. inch per second, as indicated earlier.

As ΔT is further increased, the heat transfer rate continues to increase until the bubbles are so numerous that the wall is completely isolated from the liquid by a vapor layer. This type of heat transfer is called film boiling. When the insulating layer forms, resistance to heat transfer from the wall to the liquid increases abruptly. Then, since the amount of heat being supplied to the metal wall is constant, and the heat being taken from the wall by the liquid is decreasing, the temperature of the wall increases abruptly, frequently causing a spectacular pyrotechnic display.

Engineers designing regeneratively cooled thrust chambers need an enormous amount of heat transfer data for many fluid fuels and oxidizers. For example, the maximum heat rate obtainable—without burning out the walls—by utilizing the phenomenon of nucleate boiling, varies with inlet or bulk temperatures, pressures, and fluid velocities. Generally speaking the great mass of data available from the chemical, petroleum, and power industries is not useful to the rocket scientist because it is in a regime of much smaller heat transfer rates and low ΔT. At present there is no known method for extrapolating this data with any reasonable degree of accuracy.

Reaction Motors has pioneered the investigation of heat transfer problems in liquid-cooled rocket engines. A semi-automatic apparatus for the mass production of heat transfer data for liquid propellants was built by the Physics Department in 1956. Since many of the fuels investigated are corrosive, toxic, unstable, or highly energetic compounds, their handling and measurement present interesting problems.

The small group of physicists dealing with this phase of rocket research are a part of the large family of specialists comprising RMI's Physics Department, where both physical determinations and theoretical investigation of rocket problems are challenged today and resolved tomorrow. Membership in this family is open to qualified men interested in this challenging and rewarding work.

If you desire one or more reprints of Mr. Kaechele's article, or would like to receive further information about employment at RMI, write to Information Services, Reaction Motors, Inc., 14 Ford Road, Denville, N.J.

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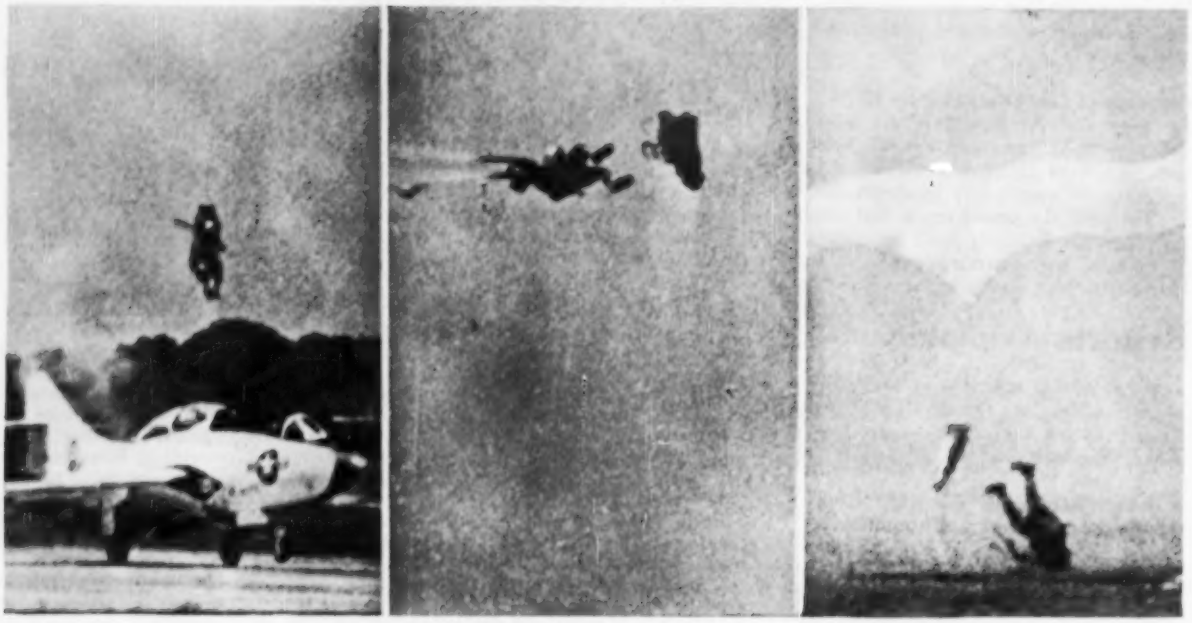
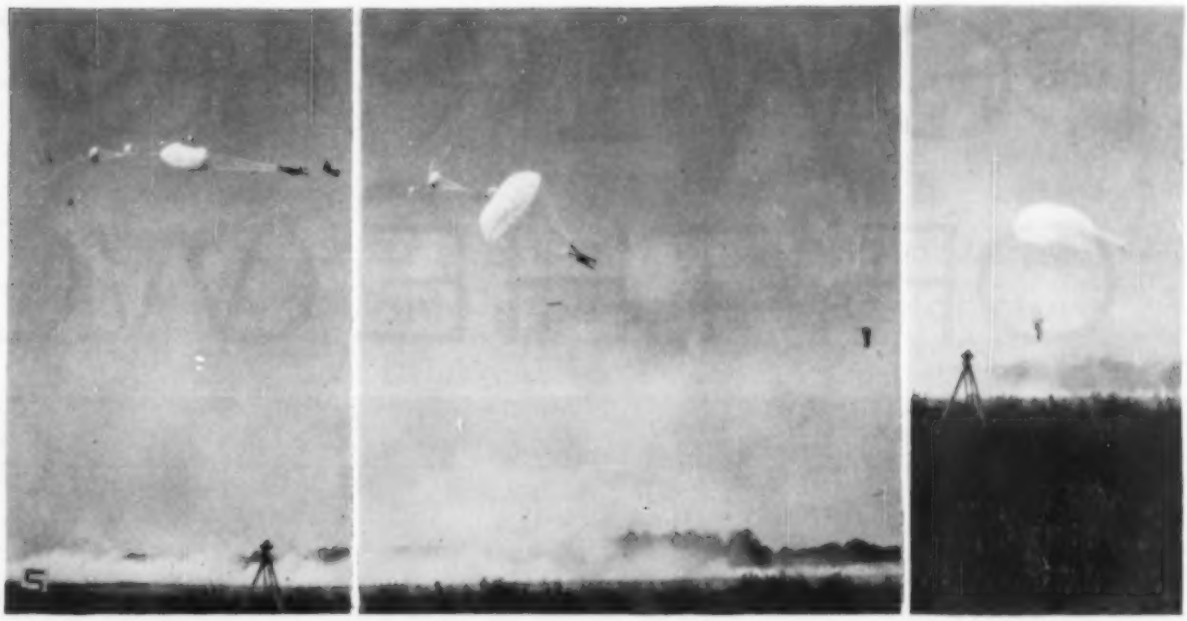


Two Ground Ejection Seats Tested In Live, Dummy Runs

Two recent demonstrations of zero altitude ejections are shown on these pages. Photographs above show a live ejection made with a British Martin-Baker Mark V ground level ejection seat; shots below demonstrate a North American seat tested with a dummy.

Three-photo sequence at upper left show Sidney Hughes of the Royal Air Force being ejected in the Martin-Baker seat from a Grumman F9F-8T two-seat fighter-trainer during a demonstration



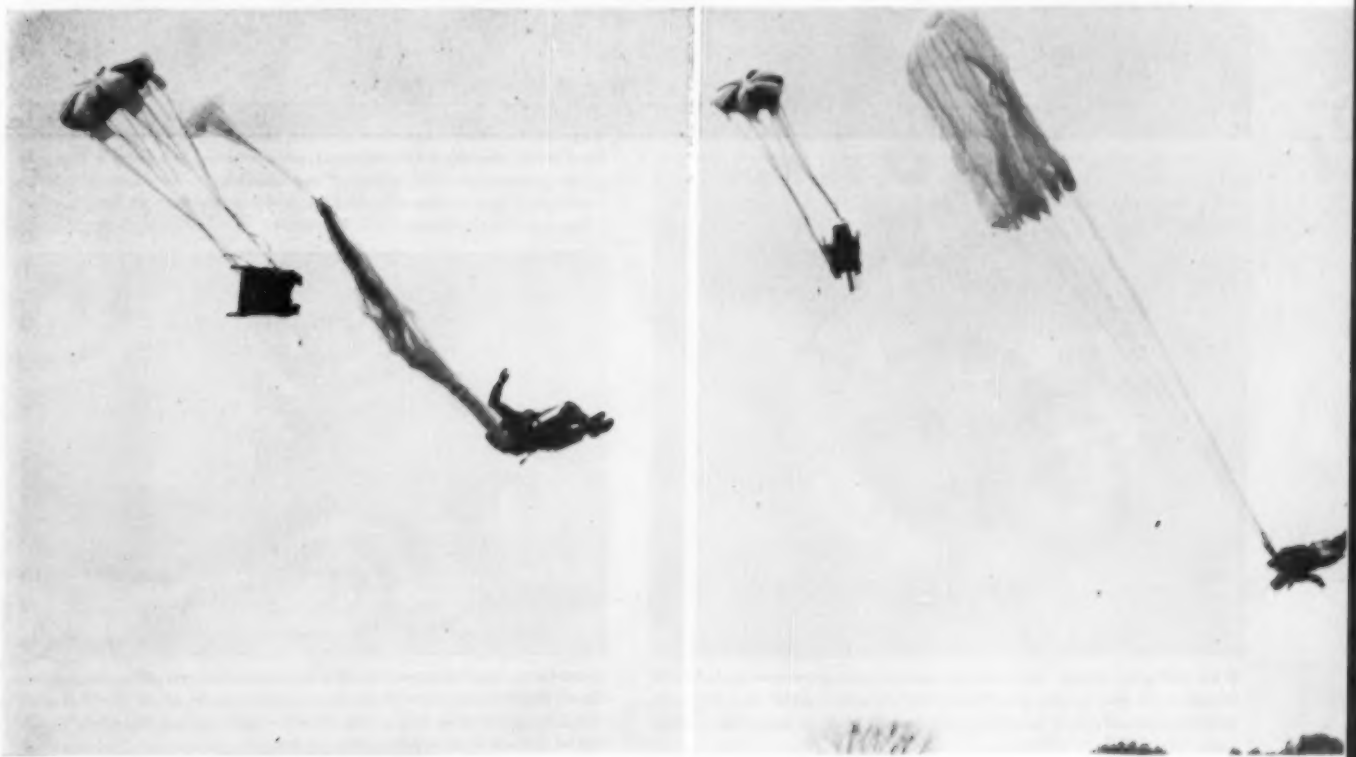
at Navy's Air Test Center, Patuxent, Md. Test marked the first time a live ground-level ejection had been performed in the U. S. and Hughes is the second man to try such an ejection.

Photos at upper left show Hughes emerging from the F9F-8T as it speeds down the runway at 120 kt. At center he is about 80 ft. in the air, his parachute has deployed and his seat is falling away. Third picture shows Hughes landing hard on his head and shoulders.

Sequence at top, right, was filmed by a different camera. After the ejection, Hughes said that he felt fine.

Grumman, which plans to continue its evaluation program up to speeds of 450 kt., holds a contract to install 50 of the Mark V Martin-Baker ejection seats in F9F-8T aircraft.

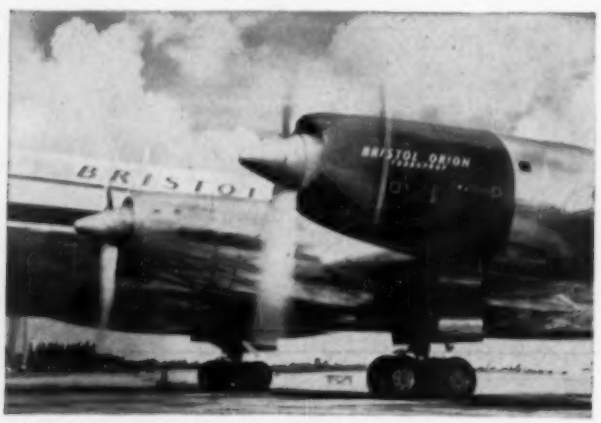
Strip across the bottom shows (left to right): anthropomorphic dummy seated in North American Columbus division-developed ground level ejection seat. Next photo shows seat and dummy ejected from a cockpit mock-up of a T2J jet trainer. Note seat's own canted rocket propellant helping seat to gain altitude rapidly. Third shot shows seat's parachute fully deployed (note that the Martin-Baker seat falls away free without a parachute) and the dummy's canopy beginning to open. Last picture shows dummy's parachute almost fully opened as tops of trees become visible at bottom of the photo.



POWER FOR
OF THE WO

The new Bristol Britannia — powered by 4 Bristol Proteus jet-prop engines—is now in service on BOAC routes spanning four continents. In a matter of months she will be the first jet age giant in US service on Northeast Airlines' routes.

The Bristol Thor ramjet produces great power at high Mach numbers in the upper air. Thor-type ramjets power the Bristol/ Ferranti Bloodhound surface-to-air missile, newly adopted as the mainstay of UK air defence.



World's first supercharged turboprop, the new Bristol Orion delivers full take-off power at all elevations up to 15,000 ft and at all temperatures. It is a unique achievement that will have a profound influence on commercial aviation.

THE WINGS OF THE WORLD

The brilliant new Britannia is only a part of the Bristol story

Another part is to be found in the design offices, laboratories, and production shops of Bristol Aero-Engines Limited. Here, for nearly forty years, Bristol designers have been producing power for the wings of the world. Power for defence. Power for civil air transport.

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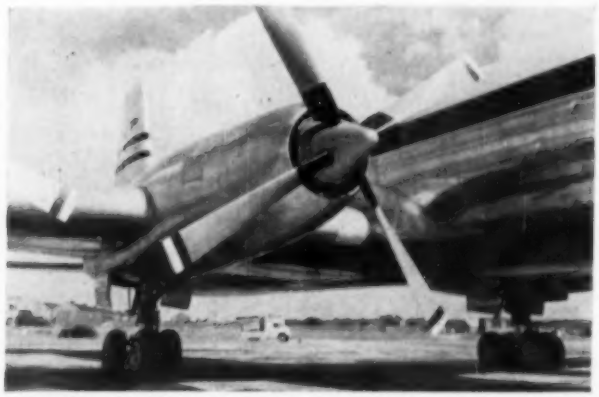
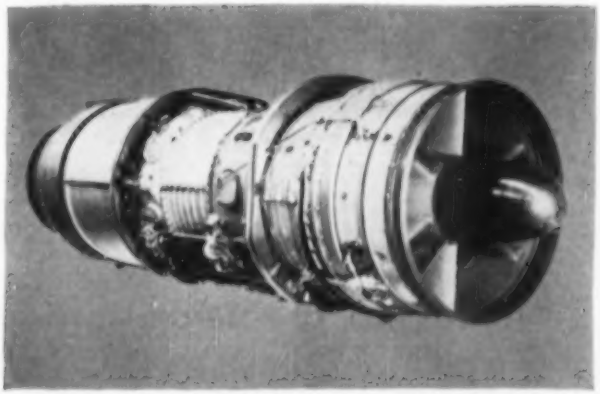


World's most economical turbine engine, civil or military, the Proteus free-turbine turboprop delivers 4,120 hp. It is also widely renowned for its flexibility of operation, unique quietness and utmost reliability.



Bristol Olympus—world record-breaking turbojet. The Olympus, holding the world altitude record for turbojet engines, has been type tested at 16,000 lb thrust—more powerful than any other type-tested engine.

Leader in the lightweight field—the Orpheus, here powering the Folland Gnat, delivers more thrust for its weight than any other type-tested engine. The Orpheus has been developed for lightweight fighters, trainers and executive aircraft.

The Jupiter nine-cylinder radial of 1920 was the first Bristol engine and, at the height of its long career, was being built under licence in 16 different countries. The aircraft shown here is a Bristol Bullet.

Note: to precision-minded men at SIKORSKY

Solving the *unusual* problem in valve requirements demands the highest degree of creative engineering and specialized manufacturing skills. Examples of Tactair's ability to deliver the "unusual" are growing in number. Proof, perhaps, that Tactair can do the same for you.

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Result: a precision brake valve for any service, having excellent control characteristics: Accurate "feel" in both application and release of pressure, due to low hysteresis and friction. Fast pressure response. Low pressure drop. Smooth control of brake pressures through full range, without hunting or surging. High flow and low leakage in both actuated and released position. The valve has a small envelope and weighs only 1¼ lb.

Reminder: on standard or special components, we welcome the opportunity to assist you with your next precision valve problem. Every job we do is done on a personalized basis. It has been that way for 16 years. Tactair Valve Division, Aircraft Products Company, Bridgeport, Pa., BRoadway 5-1000.

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Missiles Force AMC Logistics Appraisal

By Claude Witze

Wright-Patterson AFB, Ohio—USAF's Air Materiel Command sees three reasons why there must be major readjustments in its logistics to meet the impact of missile weapon systems:

• **Pace of activity** by combat units will increase at a much faster rate at the outbreak of war than it would if the weapon systems utilized manned aircraft. Even in a state of constant combat readiness there will be no actual launching of missiles from USAF sites in peacetime.

When war starts, the logistics system must spurt ahead from supply and maintenance for relatively dormant units to supply and maintenance for highly active units.

• **Dispersal of operational bases** will be vastly increased. Unmanned "birds" will be ready to go from numerous and widely scattered points, all of which must be fed at the higher pace imposed by combat. Fuel will be the major problem.

• **Determination of the best places** to store and assemble missile warheads will be more difficult than in the case of stores carried by manned aircraft. There will be more alternatives for consideration as well as more sites to be fed over more complicated communications lines.

Exact determination of the adjustments necessary to meet these conditions may be three to five years away, although AMC already has started a program of changes to take care of its missile responsibilities. (AW Aug. 19, p. 26; Aug. 26, p. 26.) When the final approach is worked out, it is almost certain to have a profound effect on the aircraft industry from the standpoint of sales, management responsibilities and industry's role in the supply and maintenance fields.

Logistics Research Division

In order to meet the challenge in logistics and a host of related fields, AMC about a year ago created a new Logistics Research Division in the Directorate of Plans and Programs. It is headed by Col. Vincent T. Cannon, so far heading a small staff of only 18 persons.

In addition to six officers, two airmen, there are 11 civilians, all carefully chosen for their talents and immunity to pressures from any type of vested interest.

Even at this early stage, work of the Logistics Research Division merits close attention from the aircraft industry.

As USAF's partner in the design, development, manufacture, distribution, maintenance and management of weapon systems, it will most certainly feel the effect of what is done by the Logistics Research Division in performing these missions:

• **Development and pursuit** of a comprehensive research program in USAF logistics.

• **Supervision of scientific** and technical logistics research studies performed by research contractors.

• **Evaluation of new and improved** techniques and systems.

• **Serving as AMC contact point for** RAND Corp. studies.

• **Coordination of research** performed in AMC.

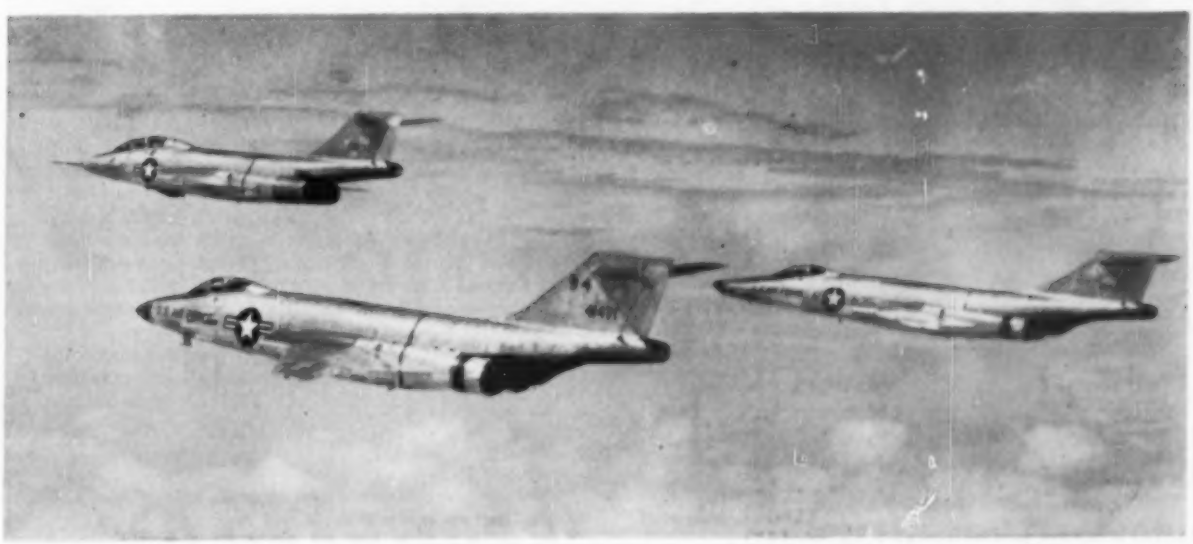
RAND, with headquarters in California, actually has been engaged in logistics studies for AMC for about four years.

Logistics Laboratory

So far, the payoff has been spotty, but the consultant has in operation a realistic logistics system laboratory.

In the laboratory, both machines and people are used to simulate the entire routine of data production and processing.

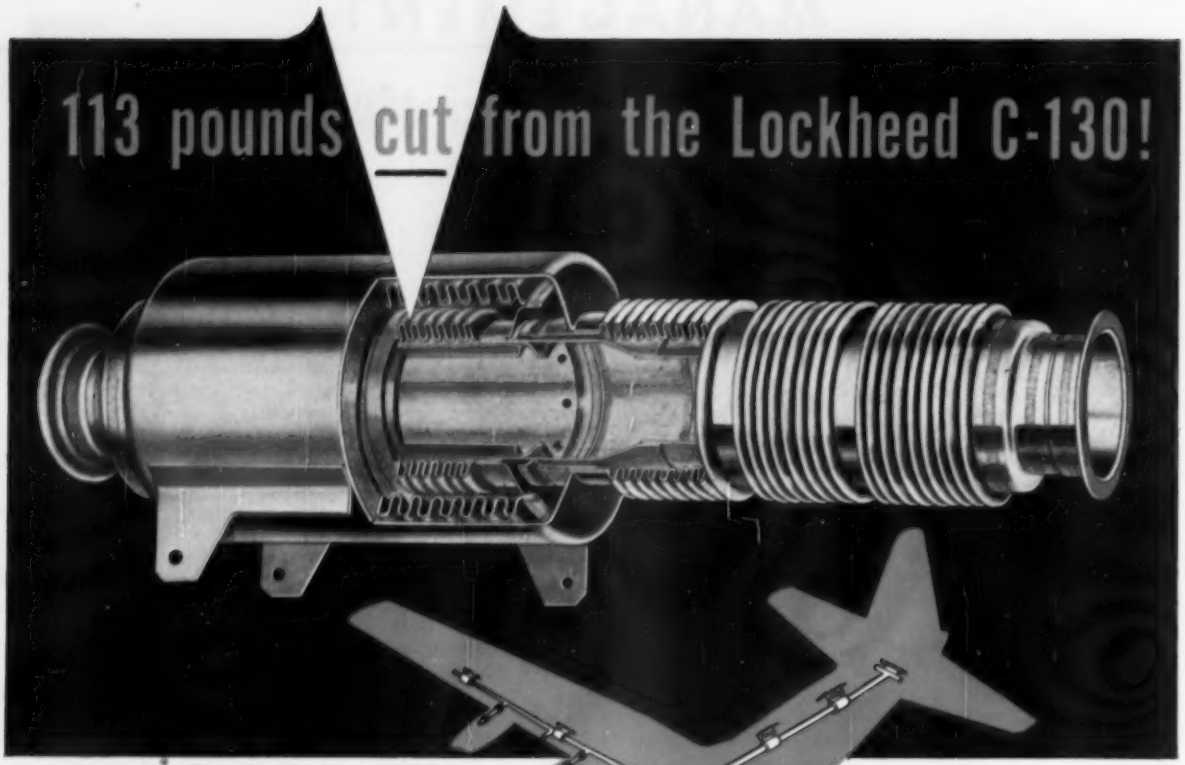
In operation since last October, the laboratory is now working on its first major experiment—an exercise in the logistics of a missile operation. Other companies now working on improved data flow and equipment are Sperry



Supersonic Voodoo Series

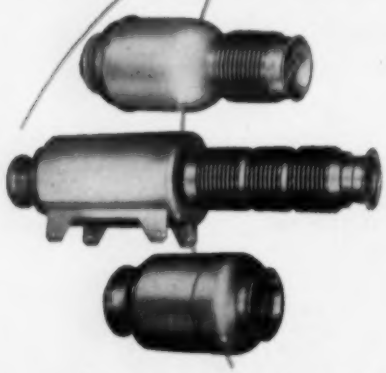
Three versions of the McDonnell Voodoo series fly in formation. F-101B (top, left) newest version of the Air Force fighter, is a two-place interceptor. F-101A (foreground), heavy on armament and long on range, is designed to deliver nuclear bombs and can perform role of fighter. RF-101 (right), operates as photo-reconnaissance unit with Tactical Air Command.

113 pounds cut from the Lockheed C-130!



PRESSURE COMPENSATOR, *or compensating bellows, utilizes internal duct pressure to create a force in a sealed chamber equal and opposite to the axial tension. It maintains a transfer of axial tension across the joint while leaving it free to absorb thermal expansion and 5° of deflection.*

"Balanced tension" duct system uses pressure compensator built by Arrowhead



THE BLEED AIR DUCTING SYSTEM of the C-130 is a network of stainless steel tubing varying in diameter from 1½" to 4". It performs eleven functions including heating, air conditioning, de-icing and pressurizing. Using three compressor sources, the air ranges from 360°F. at 35 psig to 670°F. at 145 psig.

With the ducting at an operating temperature of 670° the expansion factor is .00718 for each inch of direct length. Pressure compensators were used to absorb up to 1.8 inches of growth in key locations in the 220-foot ducting system caused by the differential thermal expansion between the ducting and the supporting aircraft structure.

This system, called a "balanced tension system," greatly reduced the number, weight and complexity of ducting supports and allowed reduction in the gauge of duct walls. On the Lockheed C-130, this system actually saved 113 pounds.

For a more complete description of the system write for the new pamphlet, "Design Engineering a Balanced Tension Ducting System for the Lockheed C-130."

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Rand and International Business Machines.

The project concerned with the impact of missiles on logistics is only one of about 40 items on Col. Cannon's agenda.

Priority List

In the top priority list, some of the projects of interest to the aircraft industry include:

• **AMC under war conditions.** Determine whether the wartime concepts of the various segments of AMC are consistent with each other. Analyze the degree to which AMC can react to emergency conditions with a fast evaluation of stocks in the system, etc.

• **Data for top management.** Determine the types of data needed at each level to provide adequate control.

• **Engineering change control.** Develop criteria for evaluating impact of proposed engineering changes on logistics. Consider this along with operational impact in determining when or whether to adopt a proposed change. For example, the difficulty of supporting a design improvement might offset the operational advantage that would result from the change. New techniques must be developed for making engineering changes with minimum lead-time and loss of effectiveness, vulnerability and waste.

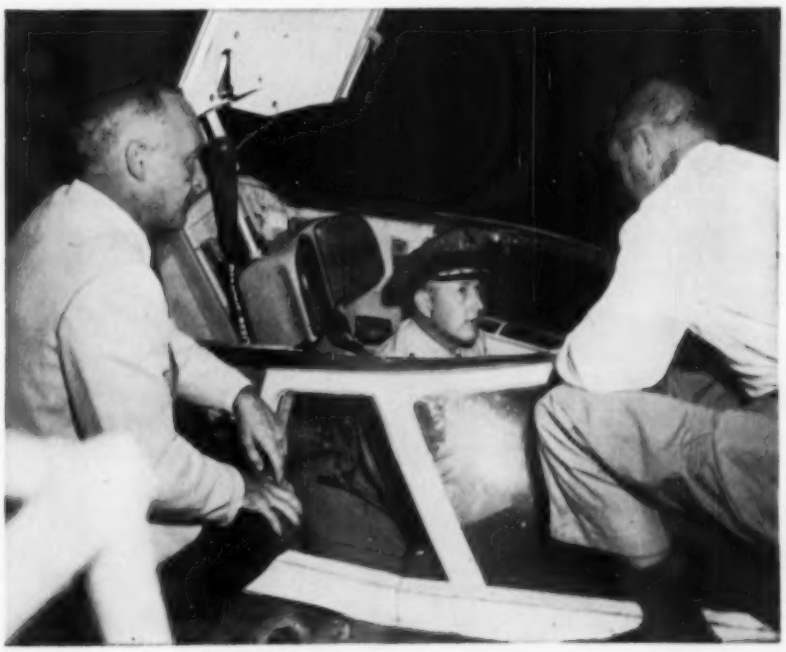
• **Initial spare parts procurement.** Analyze the entire concept of spare parts delivery, particularly in the case of government-furnished equipment where the spare may not be needed for many months following delivery of the component. Develop criteria for setting the duration of initial support. Evaluate the feasibility of obtaining spares from the contractor's own stocks as long as the end item is in production. Improve the methods for estimating spares demands and easing the stock system of parts after the initial service testing of the weapon system.

• **Maintenance of electronic equipment.** Analyze the factors that impede USAF capability to maintain electronic gear. Study the possibility of redesign to simplify maintenance. Seek better programs to recruit, train and retain personnel. One suggestion in this area would train young men while they are civilians but planning on active duty.

• **Recording and reporting of data.** Seek new, improved techniques and equipment that can be used by bases, contractors, depots, headquarters and other services. Techniques should aim at fast transmission with minimum of personnel, maximum accuracy. Coordinate contractor data processing systems with those of AMC. Analyze maintenance of records to seek the most efficient system.

• **Vulnerability.** Develop techniques for determining relative vulnerability of different logistics systems, with attention to their costs and peacetime effectiveness.

• **Distribution.** Develop techniques for



SAC Commander and B-58

Gen. Thomas S. Power, new commander of the Strategic Air Command, checking out on the controls of Convair's B-58 Hustler. He later made a short familiarization flight to help in his evaluation of the B-58 test program.

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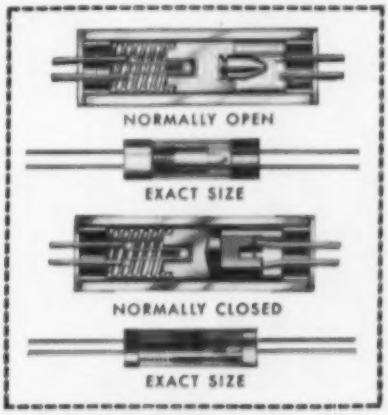

New NORMALLY CLOSED RELAYS NOW AVAILABLE. They both meet or exceed requirements for guided missiles and complex electronic gear.

They are hermetically sealed by bonding metal headers to high thermal, shock resistant glass housings.

They open or close a circuit **positively** in 0.1 second or other delay times.

They can also be safely used as a "squib" or timing mechanism.

Typical Characteristics

Temperature:	—100°F. to +450°F.
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Shock:	250 G's

Brochure containing complete characteristics and specifications available upon request.

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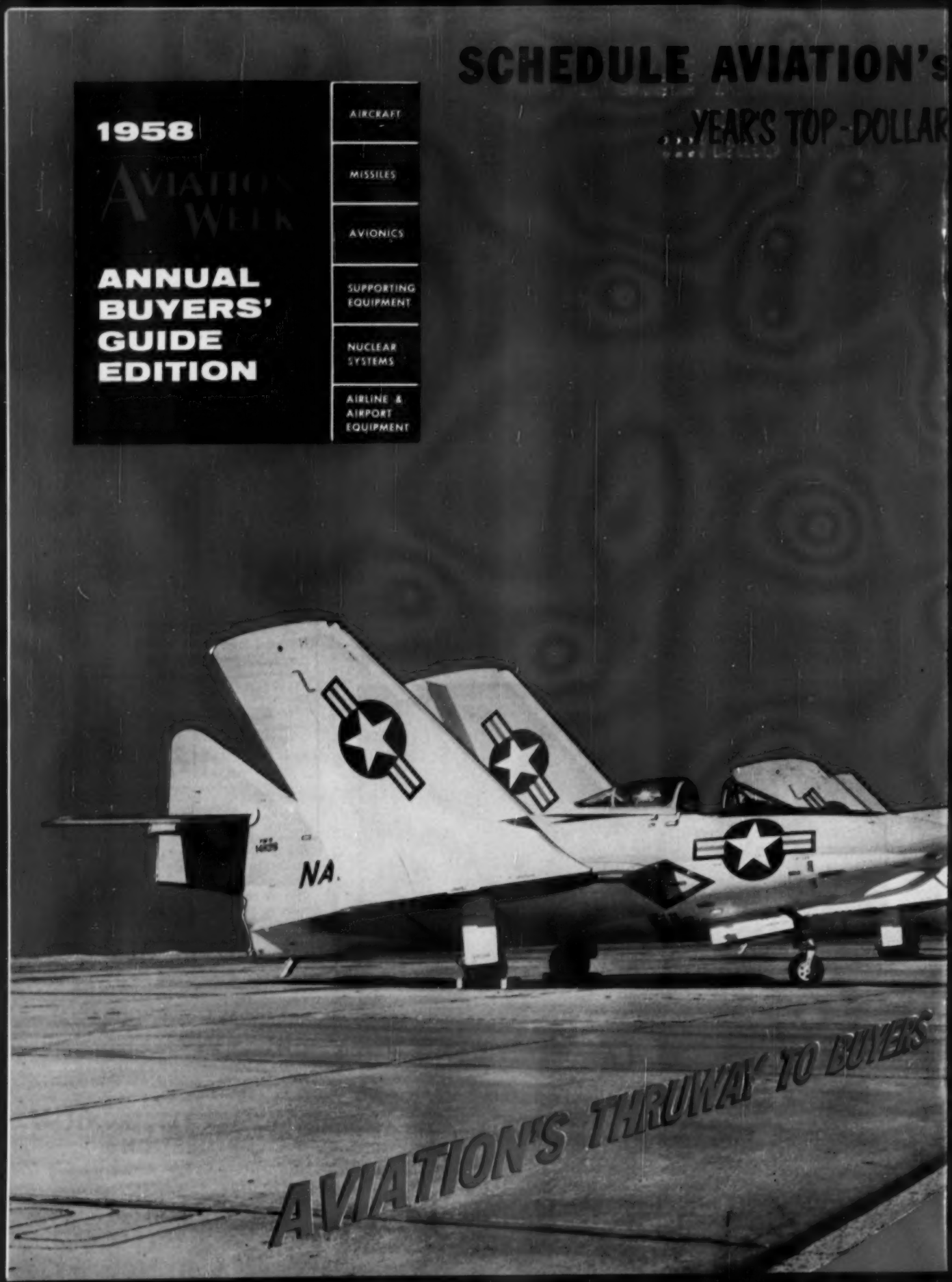
Original designs for highest reliability in glass housed miniature Relays and Resistors for all purposes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WHAT's NEW IN AVIATION PURCHASING

AVIATION WEEK editorial teams throughout the U. S. and abroad are now gathering the many thousands of vital purchasing facts that will be included in the over 594 pages of the 1958 BUYERS' GUIDE EDITION. Information-gathering questionnaires are being sent to all aviation manufacturers and suppliers in the U.S. and Canada.

Sections on aircraft, missiles, avionics, supporting equipment, nuclear systems and airline and airport equipment will contain over 50,000 manufacturers' product listings. Latest Air Force, Army and Navy and Airline procurement practices – where to go, whom to see – will be reported in characteristic AVIATION WEEK detail. Special features will include a manufacturers' index, an all-inclusive product index and a comprehensive listing of aviation distributors. These together with many other features assure the greatest possible year-long usefulness for the 1958 BUYERS' GUIDE.

EXCLUSIVE BENEFITS TO ADVERTISERS

AVIATION WEEK Annual Buyers' Guide Edition reaches aviation's largest audience of engineering-management, purchasing, independent research and military people – over 66,186 paid subscribers* throughout the U.S. and 88 different countries. Additional circulation is gained through domestic and foreign extra-copy orders from industry, military and scientific institutions.

Sectionalized Format permits advertisers to position advertisements in the appropriate aircraft, missile, avionics, supporting equipment, nuclear system or airline and airport equipment section. Last year's Buyers' Guide carried over 230 advertisers.

Advertisers' product listings are set in bold-face type and buyers are directed to advertisements for additional information through bold-face "advertisement page references". A special index of products advertised directs buyers to the product information contained in advertisements throughout the Buyers' Guide.

In addition, advertisements keyed to reader service cards make it quick and easy for buyers to request additional information about products and services advertised.

Year-round selling power and impact of 1957 Buyers' Guide advertising are shown by the over 10,000 reader inquiries received during the 1st six months 1957 from engineering-management, purchasing, and military people throughout the U.S. and abroad. (And they still keep streaming in.) Depth coverage of manufacturers is clearly indicated by the large number of reader service cards coming from vice presidents, purchasing agents, Senior Project Engineers, Design designers, structure, avionic and missile engineers etc., all with the same contractor.

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AVIATION WEEK

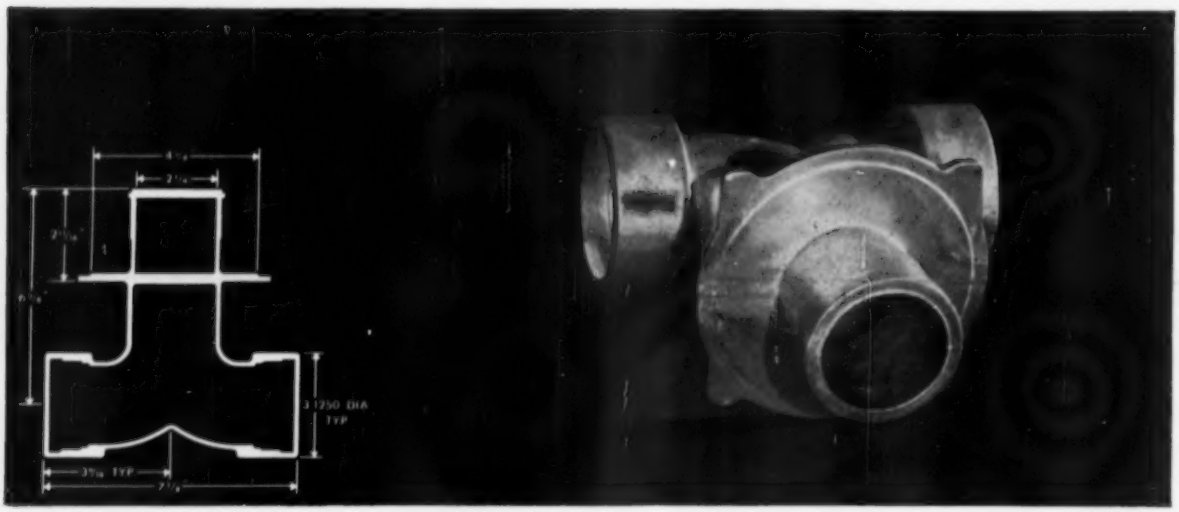
Now Alcoa offers strong, thin-wall precision castings

70 pounds saved in new interceptor fuel system

Aviation engineers have found that exterior aerodynamic requirements and internal space limitations transform today's jet aircraft fuel system into a plumber's nightmare. Necessarily large orifices and tortuous passages through and around other systems components have introduced the addition of scores of elbows and connecting fittings to supply a constant flood of fuel to the power plant. Until now, each additional fitting carried an unavoidable weight penalty.

Now, thanks to new Alcoa precision casting techniques, the finished fuel system fittings used by one major aircraft company weigh 30% less than they formerly did as sand castings. They perform better, too. Plaster cast, in alloy 356-T6, with a wall thickness of .080 in. and a tolerance of plus or minus .015 in., these parts establish a new standard in aircraft fuel line castings. Not only are they half the thickness previously considered minimum, but the tolerance itself has been halved. Although specifications still call for impregnation of these parts for fuel system service, they have thus far passed porosity tests without it. In fact, these plaster castings compare favorably with the soundness and strength of permanent-mold castings.

Savings up to 20% in time and money were realized by this company when it was discovered that the precision and concentricity inherent in the fittings made it unnecessary to prepare expensive adjustable jig and fixture setups for finish machining operations. For the complete story on how this new development in casting techniques can benefit you, call your Alcoa sales engineer. He'll be glad to work with you in developing sound, lightweight castings that can save you time and money. Aluminum Company of America, 1800-J Alcoa Building, Pittsburgh 19, Pa.



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determining stock levels at different echelons in the logistics system as well as reorder points and cycles. Investigate automatic resupply, which items could be handled on this basis and the impact of such a system on the flow of data.

• **Flyaway kit composition.** Develop techniques for building up the most effective flyaway kits for Strategic Air Command and Tactical Air Command. Kits must provide maximum logistical support, subject to limits on weight and size.

Heavy Research

Some of this research work will be done in AMC, some by RAND and the bulk by research contractors. At the outset there were about 45 projects, but the number will vary and the projects may be shifted in priority as circumstances dictate.

Record Year Logged By Canadian Carriers

Ottawa—Canadian air carriers had a record year in 1956 with total operating revenues of $180,666,000 as aganist $153,127,000 in 1955, according to a report by W. J. Matthews, chairman of the Canadian Air Transport Board.

Net operating income amounted to $9,153,000 compared with $6,316,000 in 1955.

Number of revenue passengers increased by 25% to 3,310,000 while revenue total was 147,481 tons, up 32% over the previous year.

There are now 1,700 commercial aircraft registered in Canada. The seven largest air transport companies in Canada are Trans-Canada Airlines, Canadian Pacific Airlines, Pacific Western Airlines, Maritime Central Airways, Quebecair, Transair, Ltd., and Wheeler Airlines.

TCA's gross revenue increased 18% over 1955, passenger traffic was up 23% and airfreight 20%. CPA had revenue increases of 55% on international operations, 24% on domestic operations.

Pacific Western, operating with 85 aircraft, has done most of its work in the past two years on Distant Early Warning radar network construction. This job now is almost completed, and the Canadian Air Transport Board believes other large air freighting jobs will come into being.

Maritime Central increased its gross revenue by 42% on domestic scheduled runs and entered the long-haul charter trans-Atlantic service.

It also did some DEW line air cargo work.

Quebecair, Transair and Wheeler services carried out most of their operations in northern Canada on charter passenger and freighting operations.

LINDSAY PRESSURE GAUGE used in jet aircraft. Model #6907-1 shown here in actual size; total weight .20 pounds. (Other models for missiles and special applications.)

NEW LINDSAY GAUGE

designed for jet pressure systems

The RMC-Lindsay Pressure Gauge for jet aircraft is made for extensive cycling—will meet rigid endurance and over-pressure requirements. Not even the most extreme conditions of shock, vibration or temperature disturb its accuracy. Pressure ranges from 1,000 to 15,000 psi.

The RMC-Lindsay Gauge is a bourdon tube type, using a multiple coil, helical bourdon tube with the pointer attached directly to the end of the coil. The life of the Lindsay helical bourdon coil, as compared to the traditional "C" spring bourdon gauge, is more than 10 times greater and its proof pressure limits are increased by a factor of 3 or 4. The helical bourdon tube also eliminates the use of linkages and pivots, improving the gauge's shock resistance by a factor of 5 or 10.

The helical bourdon element is, of course, not a new development. However, the RMC-Lindsay techniques in coiling, heat treatment, calibration and material specifications *are* new—and exclusive with RMC.

Whatever your high pressure gauge problems may be, why not let RMC engineering skill provide the answers. Write to either of the below addresses, outlining your particular requirements.

ROCHESTER MFG. CO., INC. OF CALIFORNIA
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ROCHESTER MANUFACTURING COMPANY, INC.
221 Rockwood Street—Rochester 10, N.Y.

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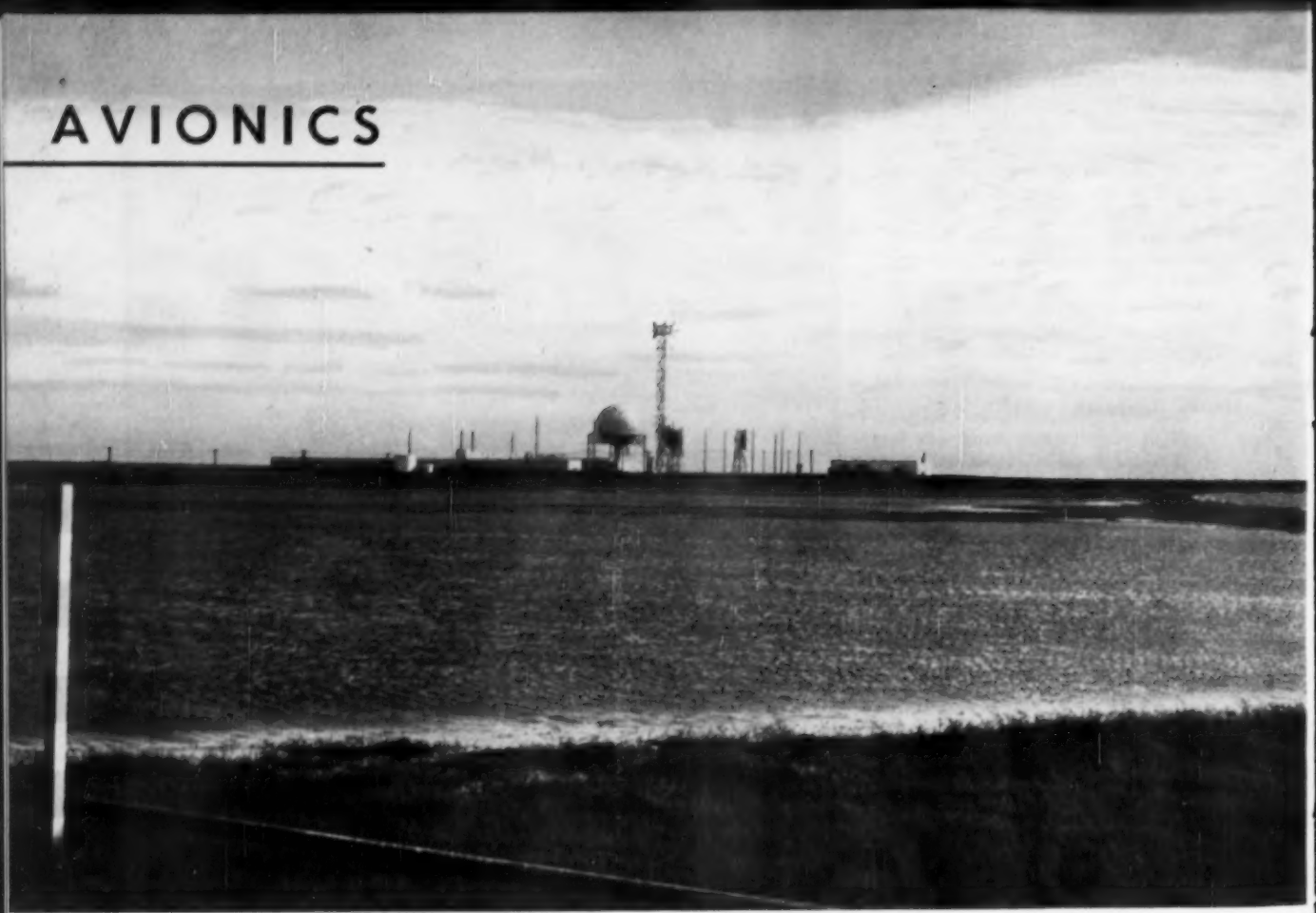
LINDSAY PRESSURE GAUGES



DEW Line station, Pt. Barrow, Alaska, is one of more than 50 radar sites now in operation in 3,000 mile Arctic network.

DEW Line Adds 100 Minutes Warning

Nearly 18 months ago, AVIATION WEEK's *Avionics Editor made a 15,000 mile tour of the Distant Early Warning Line north of the Arctic circle in 25-below zero weather to give readers a first report on this vital extension of our aerial defenses and its construction progress. (AW April 16, 1956, p. 62.) The now-completed DEW Line has been revisited to give* AVIATION WEEK *readers a detailed report on its operation and the living conditions of the civilians who man this important outpost.*

By Philip J. Klass

Point Barrow, Alaska—Distant Early Warning Line, a network of more than 50 radar stations stretching across 3,000 mi. of desolate wasteland several hundred miles above the Arctic circle is now fully operational.

Against enemy jets striking over the North Pole, the $540 million DEW Line investment should buy 100 precious minutes of advance warning time in which to muster continental defenses and launch strategic counterpunches.

Existing DEW Line radars are not capable of detecting intercontinental ballistic missiles. But when suitable radars and counter-ICBM missiles become available, these established bases in the far north, with their extensive communication and service facilities, will greatly facilitate erection of ICBM defenses.

Civilian Manned

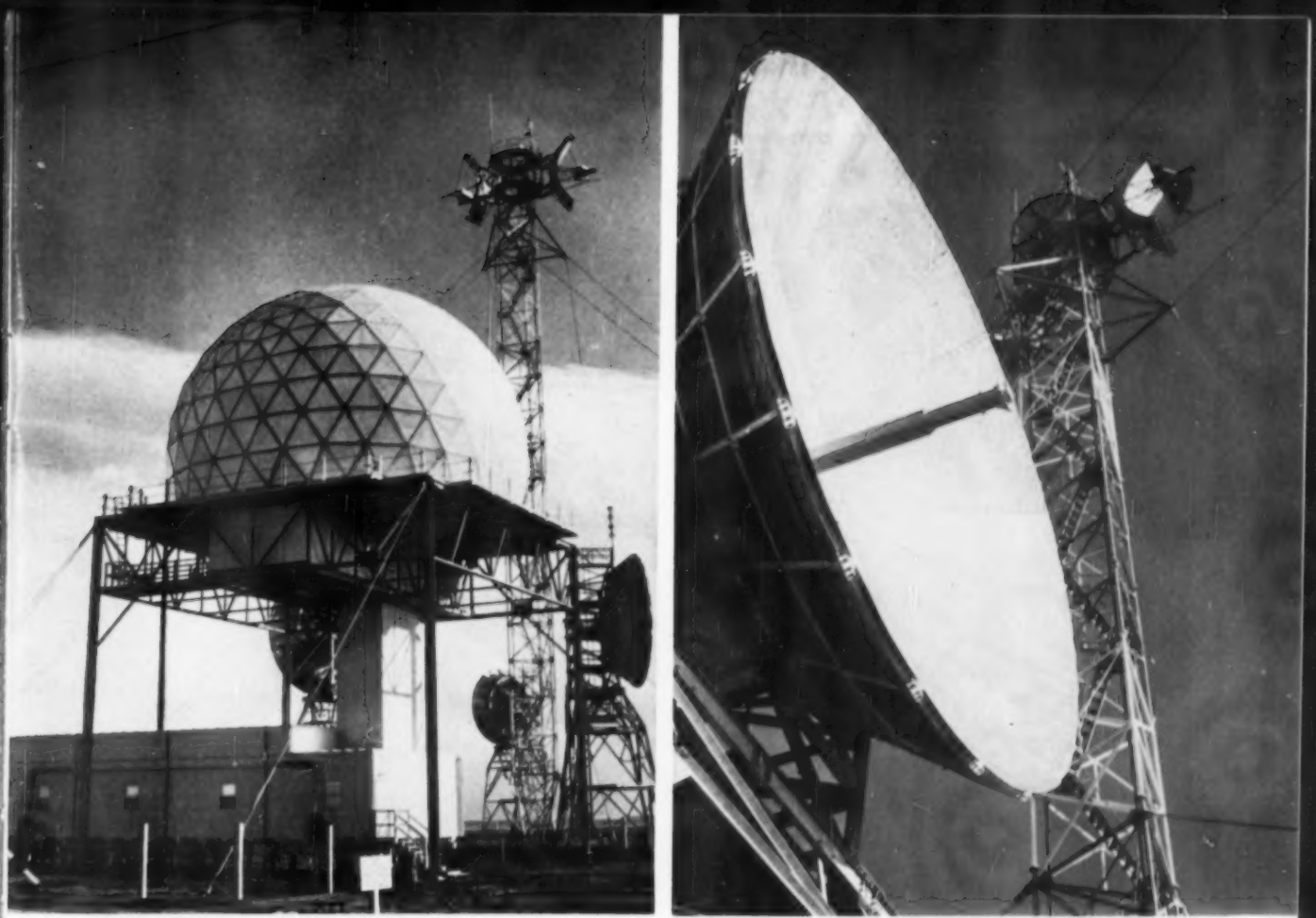
Approximately 95% of the roughly 600 persons who man the DEW Line are civilians, employed by Federal Electric Corp. (Division of International Telephone & Telegraph Co.) which is under Air Force contract to operate and maintain the line. This represents a new approach to operating a specialized military installation—an approach which might find application elsewhere.

Military personnel are stationed only at a handful of major radar stations, to make tactical evaluations and decisions and to provide Air Defense Command representation on the DEW Line. In Canadian sectors, there are both USAF and RCAF officers.

With the DEW Line in operation, USAF has released some additional details on the new radar network. Total number of stations is quoted at "more than 50," but exact number of each of three sizes of stations and their locations are left to speculation.

Two basic types of radar are employed on the DEW Line:

- **Rotating surveillance,** produced by Raytheon, provides multi-beam coverage which gives rough indication of target altitude in addition to precision target bearing and distance information. Radars are equipped with automatic alarm which alerts operators to newly detected target.
- **Stationary gap-filler** called "Fluttar" and made by Motorola is used to fill low-altitude voids in surveillance radar coverage caused by earth's curvature and/or high terrain between adjoining stations. Gap filler radar uses smaller antenna than rotating type, hence can be more conveniently mounted on towers ranging up to 400 ft. in height



MAIN DEW LINE station consists of large rotating surveillance radar (in geodesic dome, left) plus stationary gap-filler radars with antennas mounted atop 100 foot tower to fill in low-altitude voids in surveillance radar coverage. Four parabolic antennas on shorter towers (three shown at left) are used for tropospheric scatter communications link between stations.

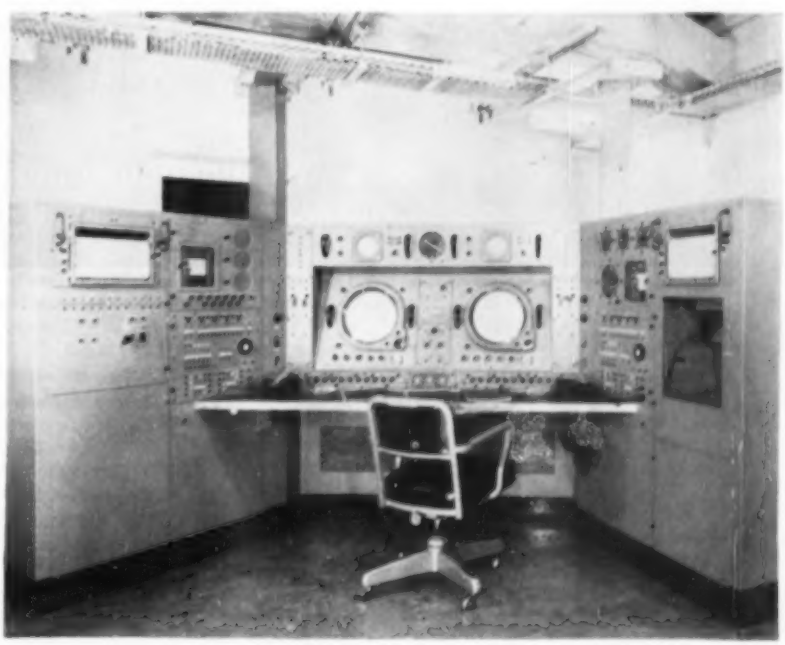
to achieve low-altitude coverage. Gap filler radar is believed to be a continuous-wave type and may employ multiple azimuth beams to give rough indication of target position and speed. When target penetrates gap-filler beam, automatic alarm is sounded.

Three Station Types

The three types of DEW Line stations, their functions and the approximate number of personnel based at each are as follows:

• **Main station** is equipped with rotating radar, plus at least two gap-filler radars. This type station serves as communications, data collection, maintenance and supply center for 8-12 smaller stations within its sector. Main site is manned by approximately 55 persons, some of whom are roving maintenance specialists, visiting other sector sites as required. There are believed to be three to five main stations along the 3,000 mile line. One is located at Point Barrow.

• **Auxiliary station** is equipped with same rotating and gap-filler radars as main station, but its physical plant is



RADAR console at main stations has two scopes to show targets at different altitudes.

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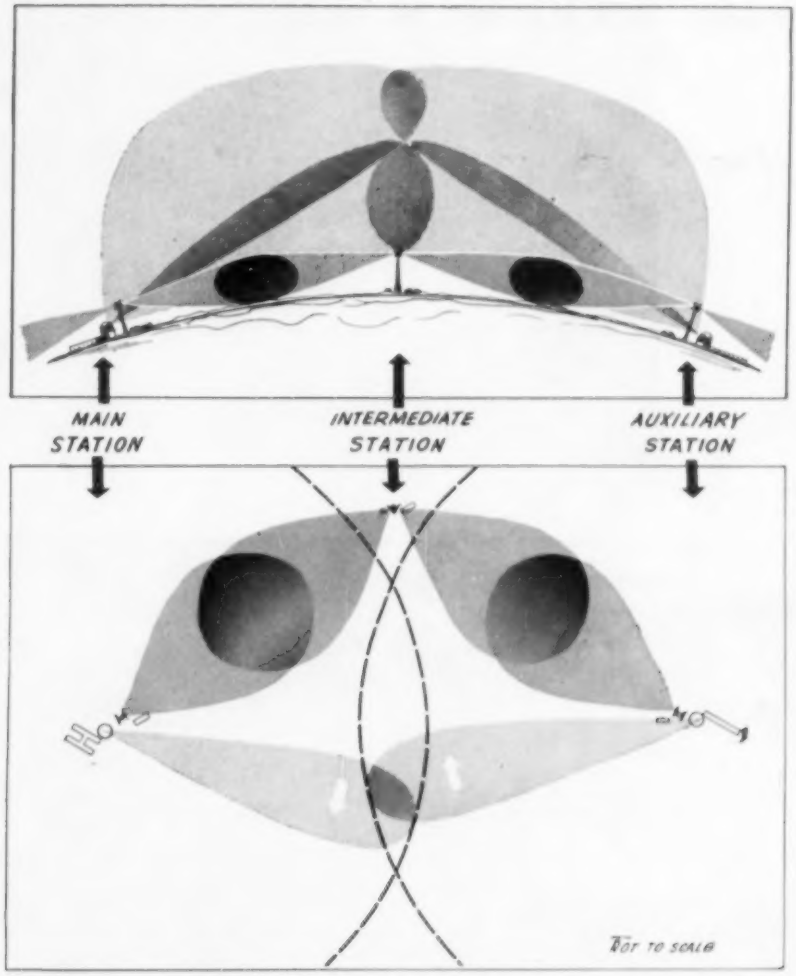

TYPICAL LAYOUT of adjoining DEW Line stations shows how intermediate stations provide low-altitude gap-filler coverage between major surveillance sites. Apparent low-altitude gap near intermediate station is exaggerated because drawing is not to scale.

only about half as big. Auxiliary station is manned by about 17 people, all civilians. There are believed to be about 20 auxiliary stations along the line.

• **Intermediate station** is smallest of the three types, equipped with gap-filler radars only and operated by only two civilians. As name implies, intermediate station usually is located between two of the larger stations to fill in low-altitude voids. However, in some locations two intermediate stations are used to fill the gap between two larger stations because terrain or supply problems make it necessary to locate the latter in sites where ideal radar coverage could not be obtained.

Penetration Tests

Series of three penetration tests have been run against the DEW Line to check its effectiveness, according to Brig. Gen. Stanley T. Wray, chief of Electronic Defense Systems division, Air Materiel Command. These tests indicate that the line is "100% effective from the deck up to extremely high altitudes against bomber-size aircraft," Gen. Wray says. Without disclosing specific detection ranges, Gen. Wray says the DEW Line radars "reach out farther and higher than any now in military use."

To foil enemy countermeasures efforts, radars are designed to permit rapid change of operating frequency.

Elaborate scatter communications networks interlace all stations along the DEW Line and connect key sites (usually main stations) rearward to Air Defense Command headquarters. Ultra-high frequency (UHF) tropospheric scatter provides voice and teletype communications between stations. VHF ionospheric scatter provides teletype and limited voice communications back to ADC. Scatter equipment was made by Collins Radio Co.

For routine lateral communication, an automatic dial telephone system per-

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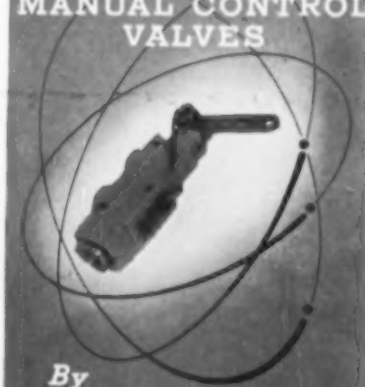

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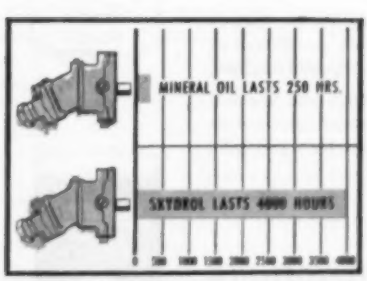

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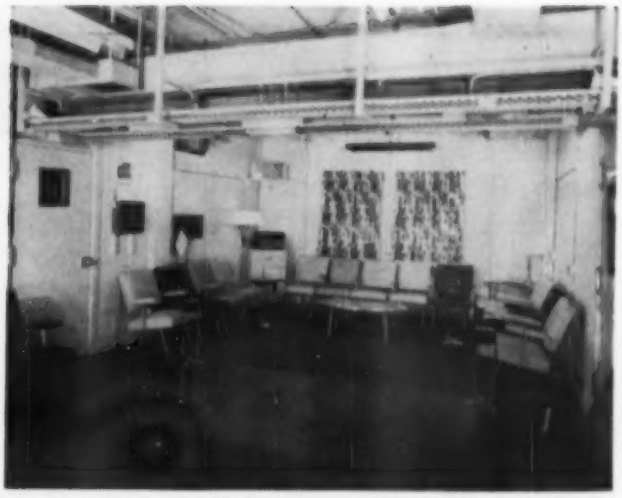

DEW Line stations provide small but comfortable quarters, including private bedroom (left) for each man. Number of recreation areas (right) depend upon size of station. Recreation facilities include photo dark room, sound movie projector, hi fi phonograph system.

mits speedy connections between any two stations anywhere along the line. Caller can either dial the extension of party he wishes to reach, or dial connection into the station's public address system to page his party.

Tactical information on radar targets (position, heading, altitude, etc.) is transmitted from outlying radar sites to main stations by type of data link which presumably permits automatic display of tactical situation in the sector.

Two large radar scopes at main station console are monitored by civilian "radicians" (radar operator-technician). One scope displays aircraft at high altitudes, the other at low altitudes. When new target is sighted, data on the intruder is set into data link transmitter by means of series of console knobs, then instantly transmitted at push of a button.

Tropo scatter links between stations each use two hyperbolic antennas, approximately 15 ft. in diameter. Dual antennas permit space diversity operation for improved performance and provide back-up in event one antenna is damaged.

Arctic Economics

Cost of building the DEW Line exceeded by one-third the original $400 million estimate. This overrun resulted from lack of previous Arctic construction and logistics experience upon which to predict costs accurately. In the Arctic where fuel oil, for example, costs $100 per barrel, it is good economics usually to make a higher initial investment in order to save on subsequent operating requirements.

In certain locations where extremely long tropospheric scatter range was needed, Western Electric decided to build extremely large (30 and 60 ft.) hyperbolic sector antennas rather than resort to higher power transmitters. Although initial cost of building the large antennas exceeded the cost of buying higher-power transmitters, the subsequent saving in electric power consumption, and hence in fuel oil consumption, more than justified the large antennas.

Another interesting example of Arctic economics is the use of waste heat from the station diesel-generators and avionic equipment to heat the complete station, despite 50-below temperatures. Each station has a small oil burner for emergency and/or supplemental heating but in most stations this was not used last winter.

Men Who Man the Lines

Federal Electric's DEW Line employes must sign up for an 18-month stint, get only a two-week vacation midway through the term, yet 70% of the men are married.

Major attraction undoubtedly is the good pay. Salaries reportedly range from about $8,000 to nearly $20,000 for top supervisors. However, there are other motivations. One married supervisor frankly admits that he signed up because of "personal problems at home." Opportunity to live in one of the few remaining outposts of civilization, which offers good hunting and fishing, appeals to many.

Chance to Advance

Some young technicians, without engineering degrees, find the DEW Line an opportunity to break into supervisory ranks. Average age of supervisors is only 32, average of radicians is 26, average for mechanics is 30. Oldest man on the line is 40.

Nominal work week consists of six nine-hour days, with one day off. However, there is little surplus manpower, particularly at smaller stations, so men are always subject to emergency duty call and there is no overtime pay.

Men are rotated among the different stations in their sector. This is particularly important for the two men stationed at the smallest intermediate sites. Normal tour-of-duty there is about five or six weeks. Each man has his own private bedroom, small but comfortably outfitted, to give privacy when desired.

Federal Electric carefully screens all personnel before hiring, then trains them for about six weeks in Streeter, Ill., before sending them north. Considerable care goes into the selection of chefs because good food, particularly pastry, is important to morale. One DEW Line chef reportedly worked at a top New York hotel, but wanted "to get away from it all" for a year. A huge bowl of cookies, fresh fruit is always available for snacks.

Each station has recreation facilities,

Company Confusion

Understandable confusion has resulted from the fact that American Telephone & Telegraph Company's Western Electric division built the DEW Line and International Telephone & Telegraph Company's Federal Electric Corp., a field service subsidiary, will operate the DEW Line under USAF contract. There is no corporate relationship between A.T. & T. and I.T. & T. The former is best known as The Bell Telephone System, while I.T. & T. is perhaps best known in the aviation industry as the result of its Federal Telecommunication Laboratories which developed Tacan and Navarho navigation systems.

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although larger stations naturally are better equipped. These include: high fidelity sound system and record library, reading library, photo darkroom and supplies, sporting goods. Stations are equipped with 16 mm. sound movie projectors and prints of the latest films are flown to and shown along the line.

Each main and auxiliary station also is outfitted with a Collins "ham" transmitter and receiver which serves both as emergency radio facility and a source of relaxation and occasional contact with home. Rig is operated by licensed radio amateurs, of which there are many among the radicians and supervisors. Soviet ham operators are occasionally contacted, but conversation is quickly terminated when their identity is established as Russian.

A PX at each main and auxiliary station supplies personal needs like cigarettes and razor blades. These are purchased with coupons from books sold by Federal.

Morale Good

Some of Federal's men have been on the line for nearly a year, going in advance of DEW Line completion to ease the transition from Western Electric's personnel. Morale appears to be excellent and men to whom AVIATION WEEK talked showed no obvious signs of homesickness or discontent. However, by Arctic standards Point Barrow is a metropolis. Several miles from the radar station is a settlement of several hundred Americanized Eskimos and a few missionaries.

Personnel attrition rate from all causes is running about two per cent

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Operating at extremely low pressures, this Whittaker Solenoid Pilot Actuated 3000 psi **non-interflow** Sleeve Selector Valve actuates at a pilot pressure of only 125 psi.

It is a high-flow valve—12 gallons per minute for a ¼-inch tube size valve.

Integral filters and provisons for manifold or stacking are provided. (Stacking height is two inches.)

Unlike conventional 4W 3P units of this type, the normal position is a flow position and the blocked position is obtained by energizing Solenoid A and the other flow position by energizing Solenoid B.

This unit, P/N 119475, is in production. Similar valves, designed to meet your requirements, will be designed at your request.

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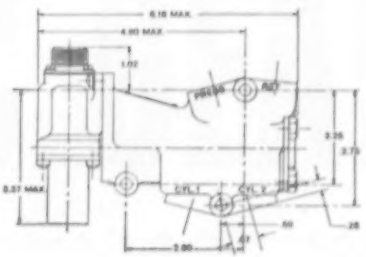
SERVICE FLUID. MIL-O-5606 Hydraulic Fluid.

ACTUATING TIME. Pilot valves of this type are inherently fast in operation. In this case the speed of operation has been dampened to eliminate extreme surge pressures.



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per month, according to Federal spokesman. There have been a few discharges. At least one decided to return to college, but most could not take the isolation from family.

Second Tour

Men who wish to sign up for a second tour of 12 months duration after completing present assignment will first get a month's vacation, then a bonus averaging perhaps $1,000 to $1,500. Personnel receive free transportation to Seattle, Edmonton or Montreal for both mid-tour and tour-end vacations and their leave period begins and ends at these embarkation points.

Men who complete their second tour will receive another bonus. If any of these indicate a desire to return for a third tour, they will have to first take a year off the line.

Day-today operations of the DEW Line stations are run completely by civilians, under a station chief. He in turn reports to a sector superintendent. The line is divided into Eastern and Western regions, each headed by a civilian manager. Top man is Richard H. Cruzen, retired Navy admiral, who is Federal's vice president in charge of DEW Line. Federal, and Cruzen, naturally take their orders from the Air Force.

Digital Computer May Mean More Creative Freedom for Engineer

San Francisco—Digital computer, already an invaluable scientific and engineering tool, may sharply alter the engineer's role and largely eliminate the frustrating 20-year lag between discovery of a new theory and its useful application.

This prediction was made by T. R. Bashkow of Bell Telephone Laboratories, in paper co-authored by C. A. Desoer, at the recent Western Electronic Convention.

"In the future an engineer will not be hired because he happens to be trained in some specific design technique," Baskow predicts. "For if the procedure is well defined, it will have already taken the form of a digital computer program. The concept of a man making a living, for example, because he happens to know how to design an insertion loss filter is obsolete. A computer will do that faster, better, cheaper. This will free the engineer for creative work for which there is, as yet, no substitute."

High-Power Theory

The average engineer will no longer be limited to using approximate solutions because he lacks the knowledge or time to apply more complex idealized approaches. "A conceptually difficult new method of solution need no longer be applied only by the inventor and those few who understand all its details," he said. "If the technique can be coded (for computer use), it becomes immediately available to all who may wish to apply it."

Network theory, and the design of networks, is one of the more complex aspects of electronic circuit engineering. Recently developed techniques for using digital computers to solve network design problems greatly speed solution time as well as providing more accurate (idealized) solutions instead of approximate solutions previously possible.

For example, network circuit design problems that previously required five months to solve are now being completed in two hours at Bell Laboratories using an IBM 650 computer, Bashkow told Aviation Week.

Before the advent of digital computers, any solution which could not be solved in a short time with a slide rule or desk calculator was considered "academic" and thus useless to the design engineer," Bashkow said.

Stimulate Theory

Bashkow predicted that the digital computer would prove a "vigorous stimulant to theoretical thought and not, as some have claimed, a substitute for thought," because the computer translates complex theory into useful numerical answers for engineering design.

In the field of network design, the potentialities of the digital computer now challenge the theorists to invent new design techniques which do not restrict themselves to the classical ideal inductances, capacitances and resistances but which take effective account of their natural parasitic elements, Bashkow said.

Digital computers may eliminate what now is known as circuit theory, broadening the engineer's horizon to system theory, Bashkow said. He compared this to the transition from the previous technique of designing multi-section filters on a section-by-section basis using simple computations to the more recent insertion loss design technique which considers the filter as a whole. The greatly increased computation required for the new filter design technique presents no problem because of digital computers.

Effect On Education

Computers will have a profound effect on engineering education, Bashkow predicted. They will accelerate the de-

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Motor				
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Control Phase Voltage	26v	115v	115v	26v
Frequency	400	400	400	400
Max. Power @ Stall	6	5	5	6
No Load Speed	10,500	10,000	10,000	10,500
Generator				
Excitation Voltage Phase 1	26v			26v
Output Phase 2	0.3v/1000 RPM 100,000 ohm load			0.3v/1000 RPM 100,000 ohm load
Null	.012v			.012v
Wobble Voltage	.007v			.007v
(Power Excitation)	3.5 watts Max.			3.5 watts Max.
Linearity	0.5% to 4000 RPM			0.5% to 4000 RPM
Potentiometer				
Mechanical Rotation	360°	360°	360°	360°
Resistance	1000 ohms	50,000 ohms	50,000 ohms	1000 ohms
Accuracy of Total Resistance	±5%	±5%	±5%	±5%
Electrical Angle	350°	350°	350°	350°
Servo Block Unit				
Ambient Temperature	−55°C to 72°C	−55°C to 72°C	−55°C to 72°C	−55°C to 72°C
Altitude	−1000 feet to 55,000 feet	−1000 feet to 55,000 feet	−1000 feet to 55,000 feet	−1000 feet to 55,000 feet
Life	3000 hours excluding pot.	3000 hours excluding pot.	3000 hours excluding pot.	3000 hours excluding pot.
Gear Train				
Ratio	1000 : 1	336 : 1	167 : 1	10,000 : 1
Dust Enclosed per	Section 4.11 MIL-E-5272A	Section 4.11 MIL-E-5272A	Section 4.11 MIL-E-5272A	Section 4.11 MIL-E-5272A
Backlash	Anti-Backlash gear on pot.	1°	1°	Anti-Backlash gear on pot.
Synchro				
Input Voltage—Stator	11.8v			
Output Voltage—Rotor	10.6v			
Clutch Brake				
Input Voltage		100v dc	100v dc	
Input Power		2.0 watts Max.	2.0 watts Max.	
Operate Time—Energize		5 milliseconds	5 milliseconds	
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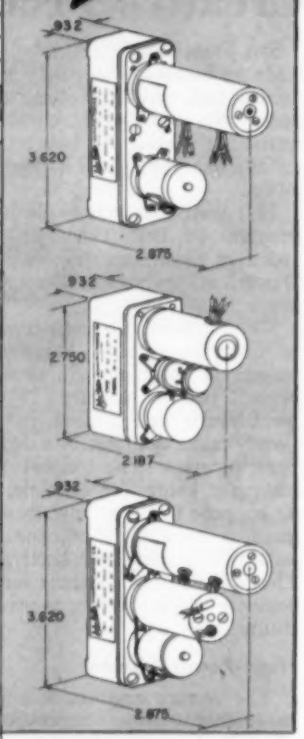

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"Future engineers will not be worthy of the name unless they are equipped to look effectively and almost exclusively at new situations in order to formulate the problems and seek their solutions," Bashkow said.

Expansions, Changes In Avionics Industry

Minneapolis-Honeywell has formed a Military Products Group, consisting of its Aeronautical division, Ordnance division and Boston division, headed by Stephen F. Keating, vice president in charge of the company's Aeronautical division. New group includes 1,000 graduate engineers, employs more than 9,000 people.

Other recently announced expansions and changes in the avionics industry include:

• **Servomechanisms, Inc.** has purchased certain assets of Precision Components, Inc., New Cassel, N. Y. Herman Sabath, former principal officer of the latter firm has been named senior project engineer for Servomechanisms' Mechatrol division in Westbury, N. Y.

• **Industro Transistor Corp.** has opened initial manufacturing facilities at 87-31 Britton Ave., Elmhurst, N. Y. Sales offices remain at 649 Broadway, New York City.

• **General Transistor Corp.** has acquired Elsin Electronics Corp., Brooklyn, N. Y. New subsidiary will be headed by Norman Jacobson.

• **Telecomputing Corp.** and the **William R. Whittaker Co., Ltd.** have merged retaining the former's name. William Whittaker becomes chairman of the board of directors.

• **Electronic Engineering Co. of California, Los Angeles,** has purchased 12½ acres adjoining its new laboratory for expansion and construction of new 20,000 sq. ft. plant for its subsidiary The Engineered Electronics Co.

• **Magnetic Controls Co.,** Minneapolis, has added 7,500 sq. ft. of new facilities bringing total to 20,000 sq. ft. Company has quadrupled floor space and personnel in past 18 months.

• **Stackpole Carbon Co.** has opened new 37,000 sq. ft. plant in Kane, Pa., for production of ceramic magnets.

• **The Narda Microwave Corp.,** Mineola, N. Y., has added word Microwave to corporate name to reflect its activities in the microwave test equipment field.

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▶ **Nip and Tuck**—Hughes Aircraft and General Electric are running neck and neck for distinction of being nation's largest producer of military electronics equipment. Although Hughes does not release figures on its annual sales, and GE does not break out its defense electronics from total company sales, each is expected to approach $400 million this year in military electronics business.

▶ **Super-Speed Memory** — Cryogenic memory cell, with response time of one hundred millionth of a second (0.01 microsecond) has been developed by International Business Machines Corp. New cell, consisting of miniature printed circuit of metallic lead, must be operated at near-absolute zero (−459.7F). Device requires only about one third the driving current needed for present-day ferrite memory elements, IBM says.

▶ **Unusual Twist**—In a period when many companies are eagerly seeking to expand their field of activity, Sylvania's Electronic Systems division has announced that it "will concentrate in fields in which it has proven experience and established competence and will not attempt to obtain business outside these areas." This statement of policy is part of new report on division's capabilities.

▶ **Fleet Air Defense**—INTACC is name of new experimental intercept tracking and control console developed by Cornell Aeronautical Laboratory and recently evaluated by Navy for fleet air defense. Equipment is designed to simplify task of shipboard air controllers in directing interceptors to target.

▶ **Signed on Dotted Line**—Recent contracts awards announced by number of avionics manufacturers include:

• **Collins Radio Co.** will provide communication and navigation equipment for Pan American World Airways new jet fleet, 22 Boeing 707s and 23 Douglas DC-8s, under contract exceeding half million dollars.

• **Radio Corporation of America** received $1.5 million Navy BuShips contract for development study of an ultra-high-speed digital computer and data processing system.

• **Sperry Gyroscope Co.** received $4 million Air Force contract for production of its AN/APN-59 airborne search and navigation radar.

• **Admiral Corp.** received $4.5 million Navy BuAer contract for airborne radio receiver-transmitters, a $3.5 million Army contract for receiver-transmitters

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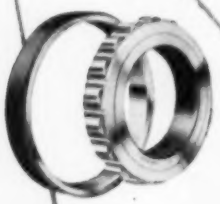

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HYATT HY-ROLL BEARINGS FOR AIRCRAFT INDUSTRY

for helicopters, and a Navy BuShips contract for over $2 million for a radar system.

• **Eclipse-Pioneer** announces a $1.1 million order for PB-20 transistorized flight control systems for use on Convair's 880 jetliners. Eclipse says it flight control will be used on new fleet additions of 17 air lines.

• **General Instrument Corp.'s Micamold Electronics** division has received Army contract to develop methods for producing capacitors with reconstituted natural mica in order to ease U. S. dependence upon foreign sources.

▶ **Siemens-Pure**—"World's purest silicon" is claimed by Westinghouse Electric Corp. with impurities less than one part in six billion. Westinghouse says it will license other companies to use silicon refining process, developed out of techniques devised by Siemens & Halske and Siemens-Schuckert Companies in Germany.

▶ **Too Many Trade Shows?**—Survey by Electronic Industries Association (formerly RETMA) indicates majority of its members prefer only two trade shows per year, less than 13% favor more than four. Average cost of exhibiting at trade show is $1,916, an increase of 14% over previous year.

▶ **Growing Crystal Filter Market**—Attractive advantages of crystal filters may double the market for quartz crystals, previously used solely for frequency reference purposes. Prediction was made by Irving Azoff of the Army Signal Supply Agency at Western Electronic Convention. Azoff predicted that use of crystal filters would grow slowly, but "in time a large percentage of the 250,000 commercial two-way radio communication sets purchased each year will contain quartz crystal filters." Ultimate peacetime market may exceed 500,000 filters per year, Azoff said.

▶ **Nuclear Communications?**—Army's Signal Engineering Laboratories are interested in possible applications of gamma radiation and neutron energy to communication and surveillance problems, Dr. Harrison J. Merrill reported during recent Western Electronic Convention.

▶ **High Definition CRT**—Cathode ray tube whose face is coated with fine-grain transparent phosphor, reportedly capable of giving resolutions of 0.0015 in., was displayed by General Electric at Western Electronic Convention. Simple color tube, suitable for radar displays, can be made by applying two or more transparent layers of different phosphors. Change of color display is accomplished by changing anode voltage using one or more electron guns.

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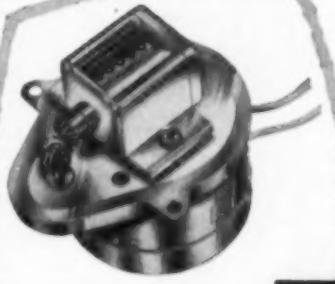

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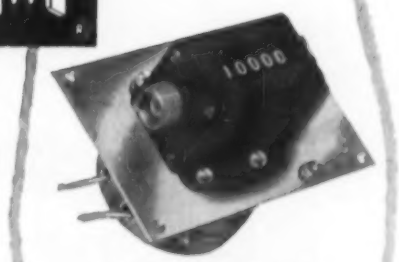
In both AC and DC, continuous or manual reset for 50 or 60 up to 400 cycle line frequency. Will measure hours or on down to 10ths of seconds. All models can be supplied with Radio Interference Filtering to meet MIL-I-6181B.



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Similarly, integrating the coming jet transports into today's complex traffic patterns calls for experience that can no longer be gained in the air alone. Crews must be acquainted with new flight and communications procedures, holding techniques . . . with new navigation aids and airborne equipment. This calls for precision flight simulation — on the ground. Already, such major airline operators as Pan American World Airways have planned DC-8 and Boeing 707 familiarization programs built around Jet Simulators designed by Curtiss-Wright. The airlines and the military alike have selected Curtiss-Wright on the basis of its proven experience with every type of Simulator.

Simulators by Curtiss-Wright realistically reproduce every aspect of aircraft operation, with the highest precision and fidelity in the industry. They add to the safety of flight, save millions of dollars and thousands of man-hours yearly for both commercial and military operators.

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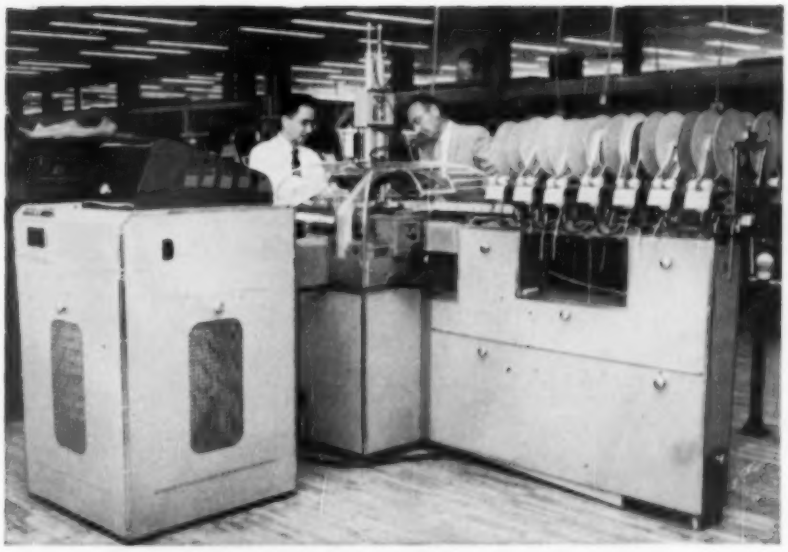


Programmed Auto-Assembler

Programmed component assembly system, operating from punched card instructions, automatically inserts up to 20 different axial-lead components in printed circuit boards at rate of 1½ seconds per component. Machine was developed by International Business Machines Corp. for own use, but improved version with component placement rate of one per second may be marketed for about $100,000. Components are mounted on masking tape belts wound on large reels, similar to approach used by United Shoe Machinery Corp.'s automatic component placement machines. IBM machine differs in its use of punched card programming. Printed circuit boards up to 10 in. square can be accommodated.

NEW AVIONIC PRODUCTS

Components & Devices

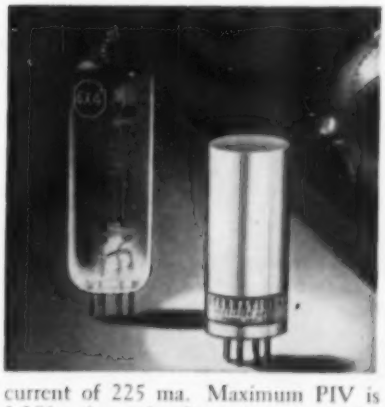
• **Subminiature relay,** Type 47, provides continuous duty to 200 C and intermittent duty to 250 C. Unit weighs

0.5 oz. and measures approximately 0.75 by 0.32 by 0.87 in. Manufacturer: Reltron Corp., Newton 58, Mass.

• **Magnetically-held** automatic disconnect switch disarms when energizing voltage drops between 13 and 5 volts. According to the manufacturer units will withstand vibration frequencies to 500 cps. at 10G loads, occupy less than 2.5 cubic in. and weigh 4 oz. Switches are available in single-pole and double-pole models from Lear, Inc., 110 Ionia Ave., N.W., Grand Rapids, Mich.

• **High Reliability capacitor,** Type B-125, is said by the manufacturer to meet all requirements of proposed specification Mil-C-14157A. Capacity drift with temperature from −55C to 125C is less than ±5%. Insulation resistance exceeds 30,000 megohms/mfd. at 25C. Units are available in 200, 400 and 600 volt ratings and in all style cases. Manufacturer: Electron Products Co., 430 N. Halstead Ave., Pasadena, Cal.

• **Tube base** mounted silicon replacement for the 6x4 full wave rectifier, S6X4 will plug directly into the same tube sockets. Unit features an output of 85 ma. d.c. maximum, input voltage of 400 volts rms., and maximum peak



current of 225 ma. Maximum PIV is 1,250 volts and voltage drop is 6 volts at 70 ma. Produced by International Rectifier Corp., El Segundo, Cal.

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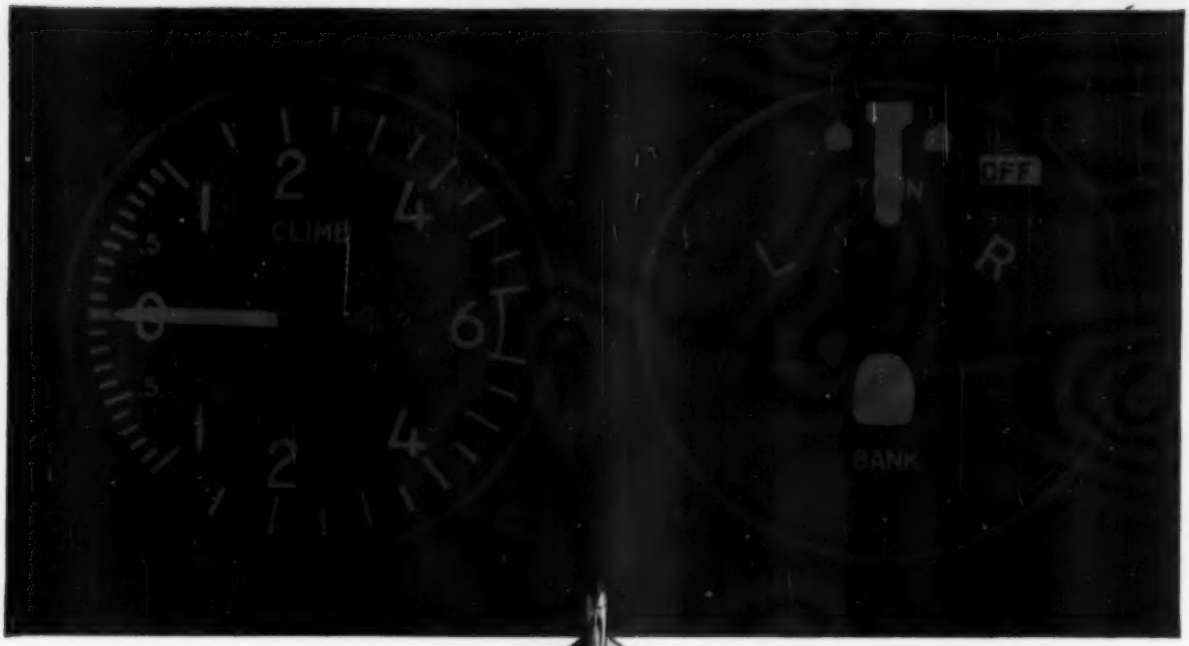

VERTICAL VELOCITY INDICATOR

MODEL 1654

Designed to meet the exacting lighting and performance requirements of jet age commercial, military and business aircraft, Pioneer-Central's new Vertical Velocity Indicator features integral lighting and rapid response indications.

Rapid response enables the pilot to quickly establish and maintain uniformly precise rates of ascent and descent during climb-out and let-down—a necessity in today's high-density traffic zones and at the high speeds of modern transport aircraft.

Another new feature—integral lighting—reads white by day and red by night. Red—the color science has proved best suited for "dark-adapted" eyes—provides sharper readability.

Model 1654 complies fully with lighting specification MIL-L-25467A and is CAA approved to TSO-C8a. Units are available in either standard 3" bezel or clamp-on style mountings.

Turn-and-Slip Indicator, Model 3922, is another new member of Pioneer-Central's family of fine instruments. It, too, provides integral lighting for better readability, reading white by day and red by night. Like its companion, at left, it complies fully with lighting specification MIL-L-25467A and is CAA approved to TSO-C3a.

TURN-AND-SLIP INDICATOR

MODEL 3922

Equally important are two additional design features—provision of a power failure indication and reduced weight. Should power fail at any time, the flag shown at "off" position, upper right, instantly informs the pilot the instrument is inoperative. Reduced weight and simplified installation are achieved by the use of a gyro motor design operating from a single-phase 400-cycle AC power source. A similar unit is available with inclined gimbal for installation in tilted panels.

Turn-and-Slip Indicators of various types are available to operate from single- or three-phase AC, DC, or air power sources. Companion instruments are in process of design and production—Airspeed Indicators—Fuel Flowmeter Systems—Breathing Oxygen Equipment.

For complete specifications write Pioneer-Central Division, Bendix Aviation Corporation, Davenport, Iowa. West Coast Office—117 E. Providencia, Burbank, Calif. Export Sales & Service—Bendix International Division, 205 East 42nd St., New York 17, N. Y.

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SUPERGHARGED Trecker Gull L2 (right) is parked alongside standard Gull L1, which has unsupercharged engines.

Aviation Week Check Ride:

Performance Rises in Supercharged Gull

By Richard Sweeney

Los Angeles—Trecker Amphibian, with high gull wings, supercharged pusher engines and the high drag normal to boat hull configuration, yields excellent performance for its class and has good flight characteristics.

Basically a Piaggio design which has been in use with Italian Navy for some years, the plane was redesigned for U.S. certification under CAR 3 Standard Category. Official designation is P.136.L2, using Lycoming GSO-480-A1A6 engines rated at 340 hp. each for takeoff, and three bladed, constant speed, full feathering Hartzell propellers.

Earlier model, now known as the Standard, was P.136.L1, used Lycoming 270-hp. GO-480-B1 engines (AW Aug. 29, 1955, p. 70).

Plane is fabricated in Piaggio's Genoa plant. Wings, hull sections and empennage units with all cables, plumbing and wiring installed are shipped to Trecker's Milwaukee assembly facility. Standard U.S. hardware and fittings are used throughout.

Use of supercharged powerplants has given the plane an increased gross takeoff weight, from 6,000 lb. to 6,614 lb. for land operation. Water takeoff gross weight for supercharged aircraft is 6,400 lb., while earlier L1 had same TO gross as for land, 6,000 lb. Higher power also has boosted performance throughout the entire flight envelope to put the amphibian into a class compet-

ENGINES are accessible to man on ground without ladder (left). Flight instruments are on left of panel, engine instruments right.

SUPERCHARGED Gull model flies over New York skyline. Lycoming GSO-480-A1A6 engines rated at 340 hp. replace 240 hp. Lycoming GO-480-B1 engines of standard Gull. This airplane and standard Gull shown on these pages are demonstrators belonging to New York distributor Hobart Cook Associated.

tive with land-based light twin aircraft.

Pilots stepping from regular light twin, small business or larger transport planes will find readjustment of pilot technique required but not difficult. The plane has good stability and control characteristics, with perhaps somewhat shorter reaction times to changes in power and attitude than have been experienced in other aircraft.

Pre-flight Check

Pre-flight walk-round check is standard with the addition of inspecting hull drain plugs for tightness. Hull has six watertight compartments with a plug in each, located just left of centerline above keel. One plug is located on right side of each wing tip float, and tip floats are interchangeable.

Inspection of compressed air and hydraulic supply is accomplished in left wheel well. Normal empennage inspection includes checking tail wheel shock strut level to insure proper retraction.

Italian design wheels and brakes, which are interchangeable left and right, are such that water and spray produce no chatter. In addition, plane can be taxiied directly from water onto ramp by lowering wheels at very slow speed before touching ramp and taxiing right on out of water.

Wide opening doors on left and right sides enable pilot and copilot to step directly into seats. General cockpit layout is good, and such that single pilot operation can be conducted comfortably, without excess or unusual reaching.

Dual flight controls are standard.

Instrument panel has conventional layout, flight instruments on left in front of pilot, engine gages on center right of panel. Navigation-communication equipment is left-center panel mounted for ease of pilot operation. Engine and primary electrical switches are on lower left part of panel, in front of pilot.

Push-Pull Controls

One different panel installation is in mixture controls, which are push-pull rods.

Bendix automatic carburetors make inflight mixture adjustments unnecessary; only movements required are at engine stop and start.

Pedestal design is standard, throttles left, propellers right. Elevator trim wheel is on right side of pedestal, farthest reach pilot must make, and is geared so that quite a bit of wheel travel is necessary if trim changes are more than slight.

Wheel-shaped landing gear operating handle is on lower left front of pedestal and incorporates mechanical lock which is self engaging when handle is moved to wheels down position. Adjacent is the tail wheel lock lever. Aileron trim wheel is just above wheel and tail wheel operating levers.

Flap operating handle is on right of pedestal, just below propeller controls. Flap hydraulic system is such that handle and flap movement are instantaneous and relative, flaps moving at same time and at same rate as handle movement. Flaps remain at whatever setting is left on operating handle.

Emergency Pump

In case of hydraulic pump failure, emergency hand pump is located between pilots' seats. Operating lever is placed in desired position, hand pump is actuated to work gear or flaps. In case of main hydraulic system failure, an emergency system is provided which will operate to lower main landing gear, and a check valve retains fluid in brake lines for one use.

On the ceiling are rudder trim, water rudder extension and retraction handle plus combination circuit breaker-operating switches for all lights and auxiliary fuel pumps.

Fuel system consists of two 95-gal. fuselage tanks in center of gravity range. A cross feed is incorporated although normal procedure calls for left engine feeding from left tank, right off right. Mechanical fuel shut off valve operating handles are located on left cabin wall just under instrument panel and ahead of door.

For pilots unfamiliar with the plane, a standard left-right check will insure safety. Engine starting procedures and sequences are standard for supercharged Lycoming. Since engines face rearward, right magneto gets starting impulse on the Gull. Fuel boost pumps are on, mixtures left in idle cutoff until engine fires. Prime is as required by temperature.

Taxi Visibility

Although Trecker Amphibian is a three-point airplane, slope of hull nose yields visibility during taxi comparable with any tricycle aircraft, and rearward slope is gentle enough to further increase tricycle impression.

Taxi technique calls for locked tail wheel insofar as is practical. With its boat hull and large vertical tail surface, plane will easily weathervane if tail wheel is unlocked. In addition, with props aft of center of gravity and near geometric center of plane, a difference can be noticed in use of power during taxi.

Although brakes are ample for extraordinary usage, best procedure is correction of undesired deviations as

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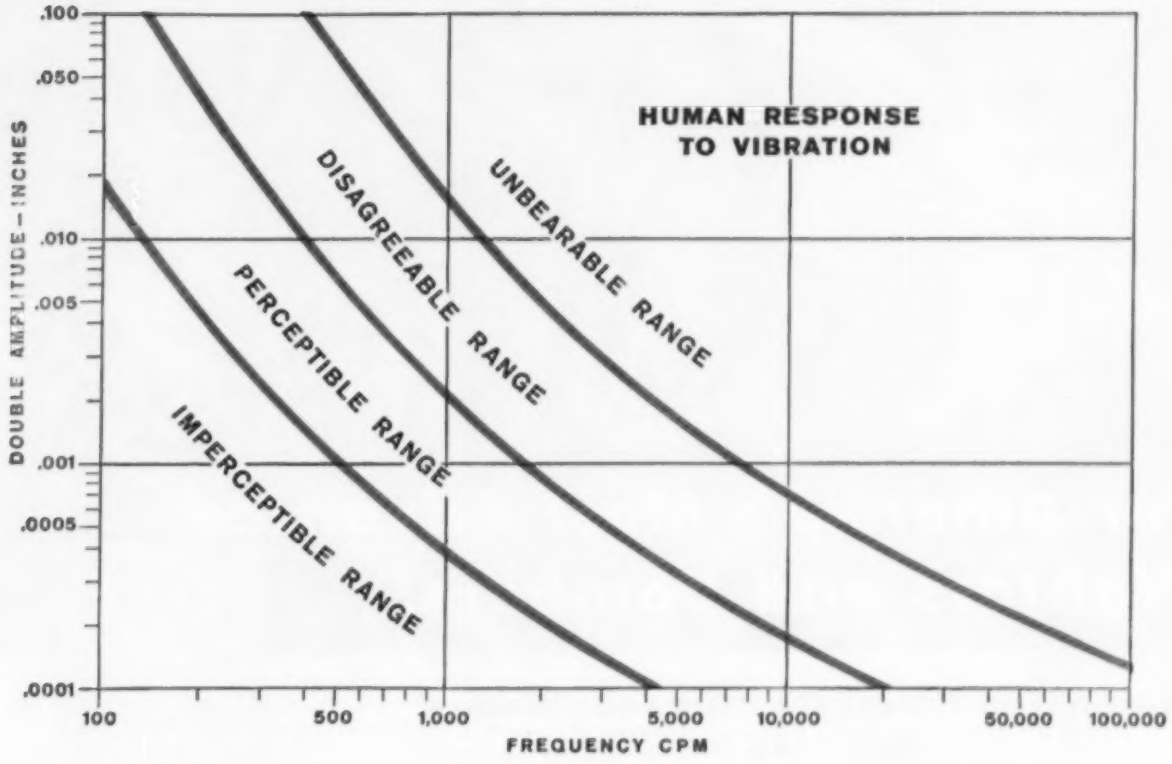

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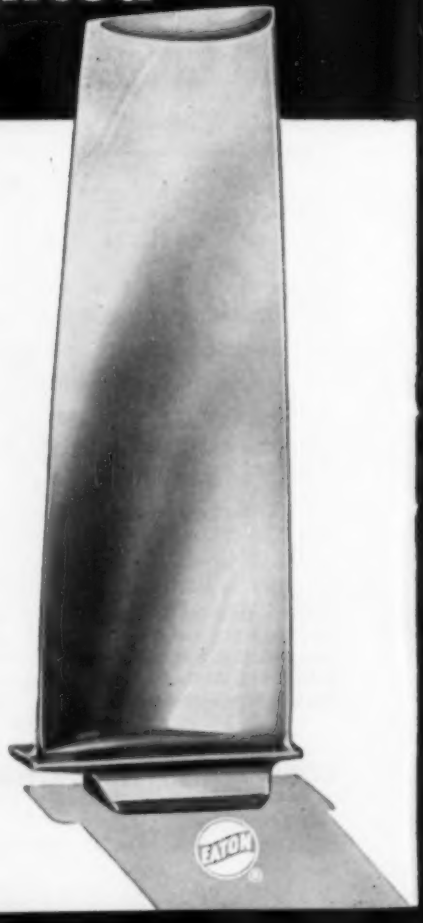
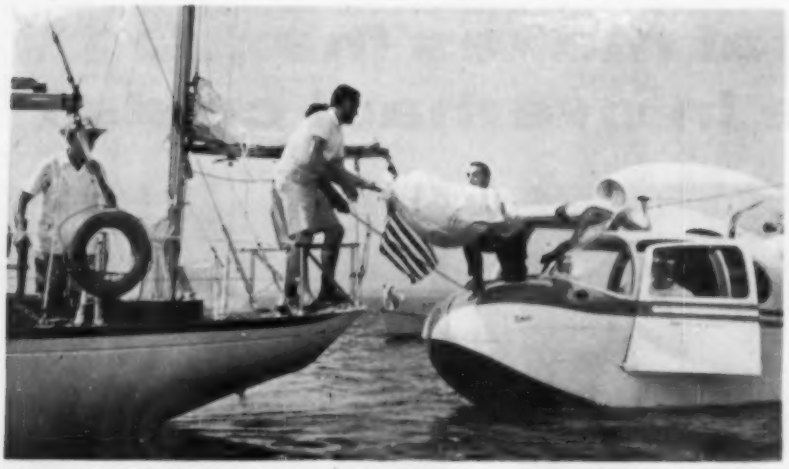
In the newest Air Force fighters and the Navy's most advanced long range patrol bombers, the new Pratt & Whitney Aircraft's J-75 engine delivers the greatest thrust of any American-built turbojet in production.

Eaton is proud to have been selected as a supplier of compressor blades for this distinguished new Pratt & Whitney Aircraft engine—blades with the superior physical properties inherent in the Eaton developed Roll-Form® process. Eaton Roll-Form blades of all types are produced by a controlled rolling operation in which the grain structure of the metal is rolled to conform to the blade contour, resulting in a blade that is strongest in the plane of maximum stress and with superior fatigue strength characteristics. Eaton Roll-Form blades are as advanced in engineering and production as are the distinguished engines and aircraft in which they are privileged to have a place.



EATON *AIRCRAFT DIVISION*
MANUFACTURING COMPANY
Battle Creek, Michigan



EASTERN DISTRIBUTOR Hobart H. Cook delivers a new nylon spinnaker sail to fellow yachtsman, Carlton Mitchell, for his prize winning racing yacht Finnistere.

quickly as possible when taxiing with tailwheel unlocked.

Engine runup is standard for GSO-480, magnetos checked at 2,200 rpm. props run through at about 1,700 rpm.

Engine Cooling

A feature of the Trecker amphibian is its engine cooling. Aerodynamics of nacelle are such that even during extended ground run on hot days, overheating does not tend to occur. In fact, cylinder head temperatures operate normally below 200C, rarely exceed this figure.

Aircraft used in the evaluation was N220A, Trecker L2 prototype-factory demonstrator. Engines were original ones, airframe and powerplants each had 475 total hr. Basic empty weight of plane was 4,600 lb., and with standard 70 lb. of equipment, was at specified empty weight for Trecker amphibian of 4,670 lb. Fuel weight was 1,140 lb., plus 56 lb. of oil. With three persons aboard and baggage, aircraft grossed 6,551 lb. at takeoff from Van Nuys Airport. Company representatives aboard were Wallace Watson and Alan Conklin. With ambient air temperature of 95F, altimeter setting at 30.07 in. Hg., and 790 ft. MSL elevation, plane broke ground after slightly more than 2,000 ft. run

Throttle Stop

In Trecker amphibian, takeoff power can be applied at lower elevations without watching since mechanical stops are incorporated for throttles which hold manifold pressures to maximum 48 in. for GSO-480. Normal flap takeoff setting is 18 deg.

The Trecker, formerly called Royal Gull, is a fairly short coupled airplane, very sensitive in yaw. Rudder is extremely effective and pressures are light throughout normal flight envelope. There is no apparent feel of flying the hull as appears in large flying boats.

Best takeoff technique calls for getting into level flight attitude as quickly as possible, with rudder applied very gently for yaw correction. Torque is almost unnoticeable due to engine location and fin effectiveness. In level flight attitude, nose slope almost gives nose down impression.

Plane accelerates steadily to lift-off speed of 85 to 90 mph. Minimum single engine control speed (V_{mc}) is 95 mph, which is passed shortly after lift off. Cleanup is good, gear retracts at average speed. Flap retraction is normal.

Climb Settings

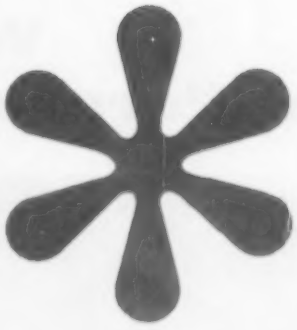
Power setting for climb was not quite METO (43 in. MP, 3,200 rpm.). Rather the usual GSO-480 setting of 40 in. MP, 3,000 rpm. was used. At IAS (indicated air speed) of 120 mph., climb rate was 1,000 fpm.

Climb rate at 15,000 ft. using full throttle 32 in. MP and 3,000 rpm. was 500 fpm., at 115 IAS. At 19,500 ft., 100 IAS, plane still registered 200 fpm. rate of climb.

Plane trims out well for cruise condition. Inherent stability is high, resulting in tendency to follow established flight path. Adjustable seat aids pilot comfort for extended cruise and noise level in cabin at lower power settings decreases from that of takeoff and climb.

Airspeed samplings at altitude at various gross weights and power settings included the following: at 20,000 ft. 63% normal rated power (NRP), true air speed (TAS) was 183 mph.; at 20,000 ft.; 53% NRP, 168.5 mph. TAS; 20,000 ft., full power, 186 mph. TAS; at 16,500 ft., METO power, 195 mph. TAS. Gross weights ran from 6,330 lb. to 6,200 lb.

High altitude stability and control investigations, conducted at 20,000 ft. at gross weight approximating 6,300 lb.,



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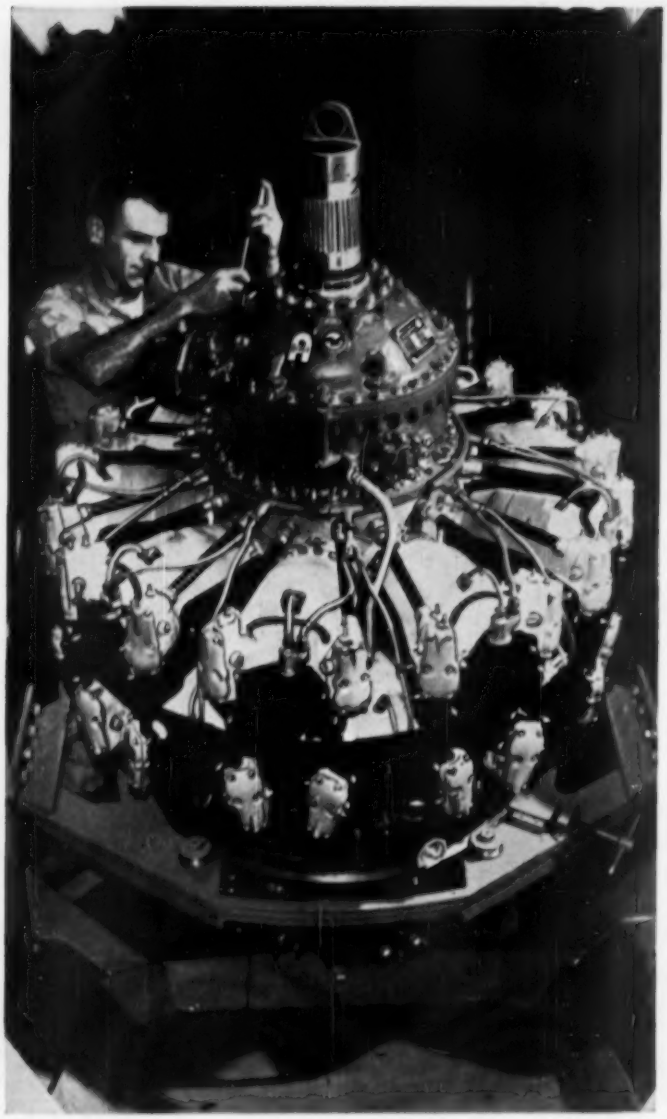
Door Seals for the 707

Passenger door seal (left) and galley door seal (right) are produced by CHR for the Boeing 707. Materials: High tear strength silicone rubber reinforced with Dacron fabric. Result: tear, abrasion, ozone and weather resistant seals, non-sticking, flexible at extreme temperatures.

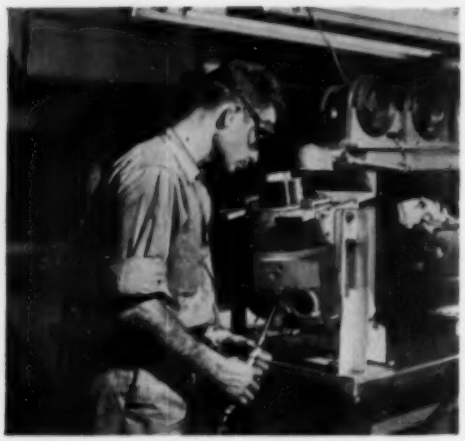
CONNECTICUT HARD RUBBER

THE CONNECTICUT HARD RUBBER CO.
NEW HAVEN 9 CHR CONNECTICUT

What makes the difference in overhaul costs?



Four basic items make-up your overhaul bill: Labor, Rework, Modernization and Replacement Parts. The first is almost constant. Every overhaul shop in the country pays about the same for equal skills; takes the same number of hours to process an engine. A high cost overhaul or a low one has the same basic labor charge.



The real governing factors in overhaul cost are the amount of Rework and Modernization done, and the number and quality of parts used. Rework depends on the judgement factor built into the minds of the men in the Shops. The extent of modernization also depends on the standards set by the overhaul agency. The more quality and reliability conscious the agency—the greater rework and modernization will be considered necessary. But the added work produces a better, safer engine.

Prices for parts range all over the lot. The highest prices are for the best . . . Factory New Parts direct from the manufacturer. The lowest prices are for the unapproved, undependable "bogus" parts. Airwork buys only quality parts—meeting modern specifications. Then gives each part an inspection on receipt to make sure it is not "bogus".

Airwork
CORPORATION
Millville, New Jersey

OVERHAULED BY Airwork

It boils down to this . . . Airwork overhauls may cost a little *more* because *more* safety and reliability has been built into the engine. You get quality you pay for . . . and save money in the reduced operating cost during the life of the engine.

indicated excellent characteristics. Stall characteristics at altitude include stall warning horn sounding at 85 mph. IAS, a stable recovery if back pressure is released at first severe buffet, and loss of approximately 500 ft. from highest point in flight path. Power setting was 53% NRP, approximating a normal cruise condition, with a straightaway flight path, clean configuration.

Aircraft holds well in steep turns at altitude, with high turn rates attainable without high speed stalls. With the aircraft's sensitive and effective rudder, degree of displacement necessary falls within rather restrained limits, incremental changes producing slip or skid.

Medium Altitude

Medium altitude investigations showed stall speed decreased to 78 mph. IAS for approximately same flight conditions, 55% NRP, straightway flight path, clean configuration, gross weight approximating 6,480 lb. at altitude of 12,500 ft. Airspeed samplings showed 155 mph. TAS at 45% NRP (24 in. MP, 2,400 rpm.); METO power (87% NRP) yielded 190 mph. TAS.

Low altitude investigation covered holding configuration at normal, low and maximum airspeeds, simulated single engine go arounds, stalls at various power settings, various configurations, one and two engines operating.

In holding configuration, gear only down, normal speed of 120 IAS at 2,400 ft., aircraft retained good stability and control characteristics throughout procedure turns and steep turns up to 50 deg. bank angle. Characteristics remained good at 100 mph IAS in level flight, climb and descent, straight and turning flight path, and at 130 IAS, maximum permissible speed with gear down, in same combination of flight paths.

Single engine go around used 5,000 ft. as simulated ground level since investigation was conducted over ocean flight test area off Los Angeles coastline. Gross weight approximated 6,000 lb. Procedure was feathering of right (critical) engine approximately 200 ft. above simulated ground level with airplane in full dirty configuration at final approach airspeed of 110 IAS. Sequence used was full power to operative engine, establish climb, sample control characteristics in trimmed and untrimmed conditions, complete shutdown of inoperative engine, clean up and retrim aircraft, restart dead engine.

Plane held altitude and established slow rate of climb when full power was applied to operative engine; airspeed was reduced to 105 IAS. Control forces were heavy in untrimmed condition and high deflections were necessary to hold airplane to desired attitude and flight path. While airplane can be held manually, fast cleanup and completion of emergency procedures eases pilot effort considerably in addition to aiding performance. In single engine go around, the airplane has a performance margin at high gross weights.

Air starting procedure follows normal sequence, requires both hands at one point, making a good trimout desirable to reduce deviations in flight path during start.

In a sustained rate climb, both engines at METO power, the aircraft held a 1,200 fpm. rate of climb from 3,000 ft. to 7,000 ft. Maximum cruise power (75% NRP) at 6,000 ft. gave the plane 174 mph. TAS.

With right engine inoperative at 7,000 ft., gross weight approximating 6,000 lb., ambient air temperature 60F, plane registered 120 mph. TAS with maximum cruise (75% NRP) on operative engine, conditions simulating sustained cruise on one engine.

Low Altitude Stalls

Stalls at low altitude, 6,000 ft., showed a decrease in stalling speed from 95 mph. IAS down to 90, 85 and 80 mph. IAS, as airplane configuration progressed from clean through gear down, gear and approach flap, gear and full flap, at cruise power.

When the aircraft is held through the buffet region into a full break, a sharp nose down pitch and right hand roll occurs, requiring high control deflections for recovery, and resulting in loss of altitude. Same conditions hold true when airplane is forced into the complete stall with one engine inoperative, with a proportionate increase in pitchdown and roll magnitude.

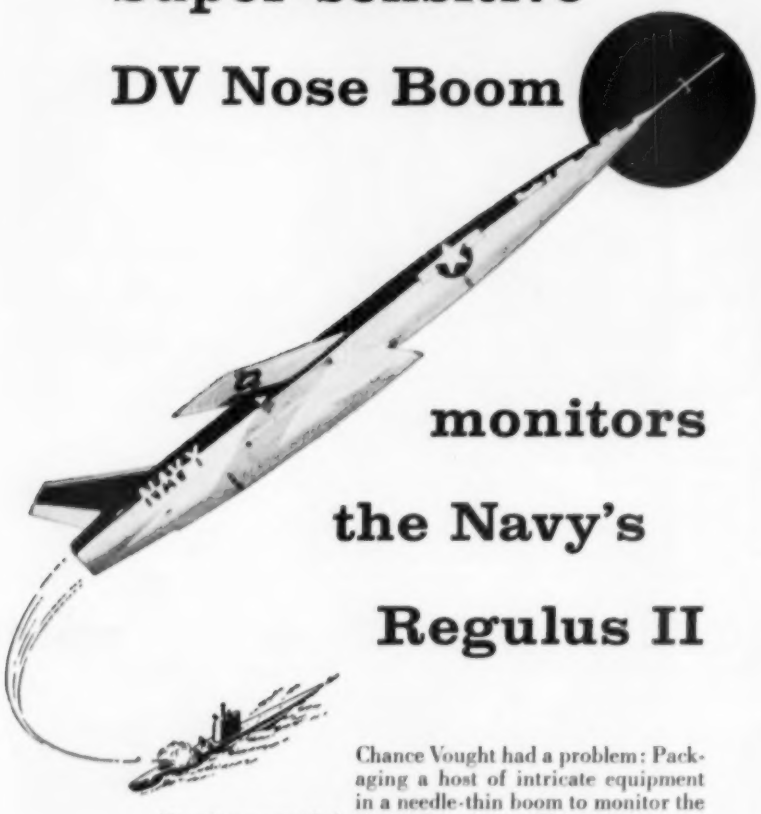
In maximum performance takeoffs and landings, aircraft easily reaches published specifications. Samplings were taken on hard surface runway, gross weight approximating 5,950 lb., ambient air temperature 95F. In landings,

Mosquitoes to Cover Arctic Islands

Modified Mosquito 35s will be used by Spartan Air Services Ltd. to survey 220,800 sq. mi. of Arctic islands to within 500 mi. of the North Pole. Company is one of three firms given contracts for the photographic work by Canadian government. Spartan contract amounts to $2,833,356. Other two firms are Photographic Survey Corp., Toronto, a British Hunting Group subsidiary, and Aero Surveys Ltd. of Vancouver. Spartan's five Mosquitoes will cover triangular area from 30,000 ft. to provide basis for new maps and will include siting of DEW Line, the southern boundary of the triangle. Spartan may build two new landing strips in the area.

Another **DALMO VICTOR** *achievement*

Super-sensitive DV Nose Boom monitors the Navy's Regulus II



Chance Vought had a problem: Packaging a host of intricate equipment in a needle-thin boom to monitor the Navy's new guided missile, Regulus II. This "packaging" was additionally complicated by the requirement that to conserve storage space on board a submarine, the boom must fold pneumatically by remote control.

Dalmo Victor's engineering skill, acquired through development of airborne radar scanner designs, provided the answer!

The ten-foot DV pitot static boom, as accepted by the Navy, meets these most exacting design requirements and provides vital data, including airspeed and altitude, as well as angles of attack and yaw.

Long-recognized leader in airborne radar antennas, Dalmo Victor now applies its experience and skills to create missile components. Contact the nearest DV office for help in solving similar problems.

DV

DALMO VICTOR COMPANY

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SALES: Dayton, Los Angeles, Washington
FIELD SERVICE: Baltimore, Belmont

Gull Performance

Cruising speed, 70% power, 13,500 ft.	190 mph.
Rate of climb, (two engine), sea level	1,279 fpm.
Rate of climb, one engine	276 fpm.
Service ceiling	25,500 ft.
Stalling speed, landing configuration	72 mph.
Minimum one engine control	91 mph.
Range, 50% power at 14,000 ft.	900 mi.
Takeoff distance, land over 50 ft. obstacle	1,440 ft.
Takeoff, water, no wind	14 sec.
Landing, over 50 ft. obstacle, full flaps	1,800 ft.

advantage can be taken of plane's natural high hull drag to establish power balance on final approach, effect a swift flareout and power reduction, putting the aircraft onto the ground quickly.

Water performance investigations were performed at Lake Mead, Nev., altitude 1,220 MSL, ambient air temperature on water surface was 102F. Gross weight approximated 6,400 lb., maximum for water operations.

Landing technique calls for leveling off just above water surface, cut power and allow the aircraft to stall onto the surface in nose high attitude.

Takeoff techinque calls for aileron displacement until airspeed is gained, pulling the aircraft onto the step, becoming airborne at approximately 80 mph. IAS. Flap setting is 18 deg., same as for land takeoff.

Minimum takeoff run registered was 17 sec. from power application until aircraft was definitely airborne. Maximum takeoff run time was 21 sec.

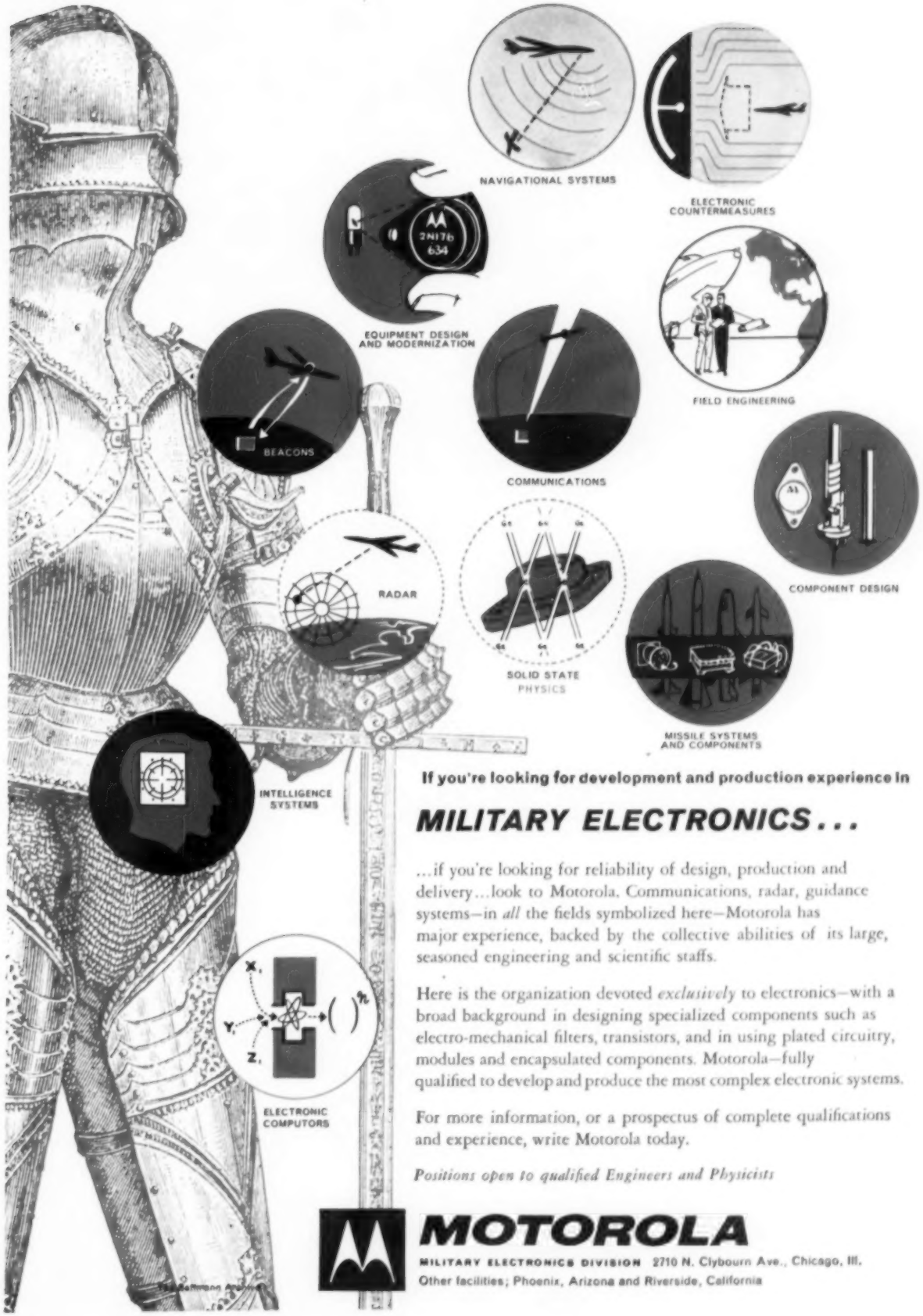
Water taxi characteristics were excellent, water rudder was effective at proper speeds, with good stability from wing floats in turns. Using differential power for directional control in water taxi requires care.

Plane's overall performance on water was excellent. Windows stayed free of spray at all times, although water surface was relatively calm.

Although Trecker amphibian's range is shorter than land based planes of same general weight class at higher airspeeds, company indicates studies have shown normal amphibian operations are shorter flights than with landplanes.

For equipment, Trecker has been installing two Dare omni sets, 22-channel transmitters, with localizer needles. Company plane also incorporates glide slope receiver, registering through one of the Dare units, a setup which is available to customers. Weight of equipment was 70 lb.

Present production plans call for the L2 supercharged version, but customers may order the standard L1 aircraft.



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R.W.F. (Big Bob) Schmidt, Manager, Tucson Airport Authority

There's a team in Tucson worth knowing about!

Big Bob Schmidt and Shell, working together at Tucson, Arizona, Airport have increased aviation fuel sales fivefold since 1948!

Seems everything's big at the Tucson Airport—Big Bob, big sales . . . and big plans that are underway to extend the 12,000-foot runway to 15,000 feet, making it the longest in the world!

"One of the things that attracted us to Shell," says Bob, "was the company's reputation for helping dealers grow. We knew there must be good reasons for it. We soon found out. Giving engineering and other specialized assistance to help dealers build for the future is one secret of Shell's position as an aviation supplier.

"For example, when we needed more bulk space, Shell engineers designed and supervised the construction of storage facilities.

What's more, Shell's technical representative is always here when we need him, making our job of keeping our customers satisfied a lot easier."

And at Tucson, customers *are* satisfied. Pilots know that a Tucson stopover means a lot more than sunny weather. Big Bob gets them in and out again—fast! He delivers the kind of service they need for on-schedule take-offs every time.

Responsibilities fall on Bob Schmidt when he's *away* from the airport too. Bob is president of the National Foundation for Asthmatic Children, president of the American Association of Airport Exccutives, a director of the Tucson Metropolitan YMCA, and chairman of the Y's Southside Branch.

Shell is constantly on the watch for men who can build careers to match that of Bob Schmidt.

Corporate plane taxies past control tower on way to spacious parking ramps. New operations' building and ten-story tower are under construction.

Big Bob and Shell representative "Nebby" Nebeker stand near bulk storage tanks discussing plans for still further expansion of airport facilities.

Speedy turnabout service is provided for huge airliners landing at Tucson. Efficiency results in on-time take-offs.

It pays to be a Shell Aviation Dealer

—and the Shell office nearest you will be glad to show you why

SHELL

THE F-105
THUNDERCHIEF
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CESSNA 310B in flight. Improvements are concentrated largely in improved handling characteristics and styling changes.

Cessna Improves Handling in Model 310B

Los Angeles—Major changes in flight envelope and characteristics in Cessna's 310B model involve expanded operating limits rather than basic flight and handling characteristics. Other changes (AW July 8, p. 128), are mostly for comfort and styling.

One of the most important changes is in minimum single engine speeds, and while standard 310 evaluated by AVIATION WEEK last year (AW July 16, p. 50) had a minimum single engine control speed (Vmc) of 93 mph. indicated air speed (IAS). New model's Vmc is placarded at 80 IAS, a reduction of 13 mph. However, 310B has a placarded minimum safe single engine climb speed of 93 mph. IAS.

Extra Margin

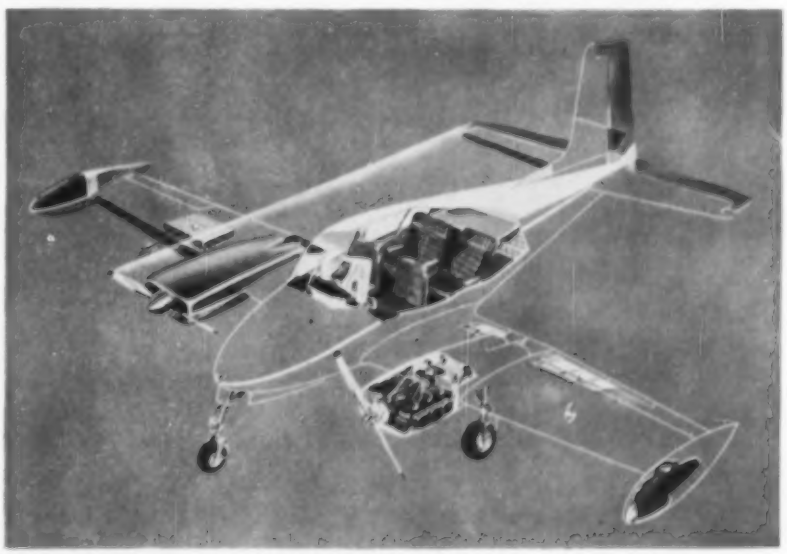
In pilot checkouts, difference is this:

• **Formerly,** if airspeed was below 93 IAS, landing could have been considered committed. Now, if airspeed still exceeds 80 IAS, safe go-around can be considered and initiated if pilot chooses.

However, check pilots are instructed to make sure that pilot being checked out realizes that acceleration to the 93 mph. figure is a requirement, and that airplane should be cleaned up quickly while in a near level attitude, in which case the acceleration will be quick to the desired airspeed. No changes have been recommended in standard two-engine landing technique or placarded speeds.

Since the plane now has 100 lb. heavier maximum takeoff gross weight, of which 35 lb. has been picked up in useful load, there have been some changes in recommended climbing speeds, plus increases in stalling speeds at various angles of bank at various gross weights. Biggest change here is in best angle of climb speed, now recommended at 88 mph. IAS for sea level and 98 mph. IAS at 15,000 ft., where formerly, speeds of 103 IAS at sea level and 123 IAS at 15,000 ft. were placarded. Placarded stall speeds are up from 2 to 6 mph. in the various conditions.

Fuel management has been changed if the offered auxiliary tanks are installed. The tanks incorporate no boost pumps, so start, takeoff and climb (first



CUTAWAY indicates areas with changes. They include tip tank configuration, more compact nacelles, flush riveted tail, electrically operated split flaps, redesigned interior.

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FREE TO PILOTS! See your nearest Esso Aviation Dealer for a free Flight Sequence Card, containing everything from VHF frequencies for private pilots to traffic control light signals.

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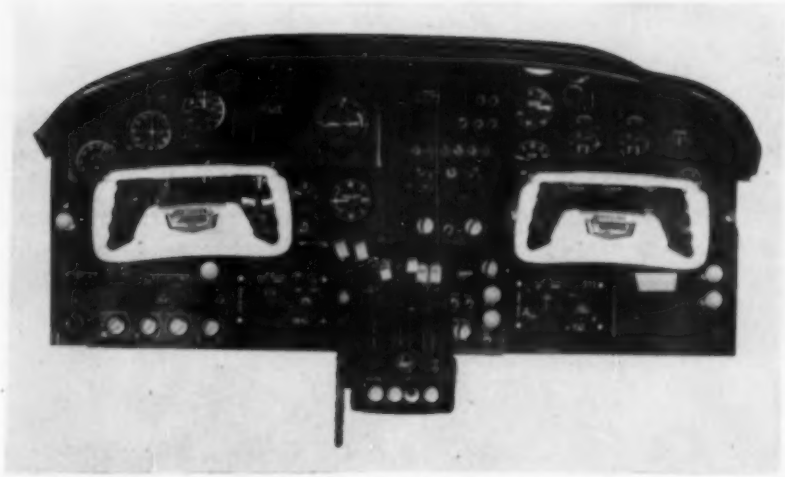

INSTRUMENT panel is new. All navigation and communication equipment is located in center and accessory options have been relocated. New lighting uses red post lights.

30 min. operation) on main tanks is recommended. In addition, since carburetor return lines still vent into main tanks, space is allowed for vapor and fuel return to mains while the 15 gal. usable in each of the auxiliary tanks is being consumed.

Other differences include a placarded speed of 160 mph. IAS being permissible for lowering of flaps up to 15 deg. In addition, maximum speed with gear down and full 45 deg. flap is now 140 mph., up 10 mph. from earlier model.

Number of changes resulted from USAF evaluation of the plane, which it has ordered for utility transport work. USAF work with plane showed new speeds and limits possible without structural strengthening and other changes, and so as not to be operating the plane in violation of or in discrepancy with commercial version, new speed recommendations and load situations were presented to CAA which approved them for commercial operations in 310B.

Cessna Plan Eases Demonstrator Terms

Wichita—New type of demonstrator finance plan designed to permit more operators to take on responsibility of a dealership will be made available about Oct. 1 by Cessna Aircraft Co.

The plan, which will be handled by National Aero Finance Co., a wholly owned subsidiary, will allow dealers to purchase demonstrators at a lower initial cost and with lower monthly payments.

Using a $10,000 model 172 as an example, the dealer could purchase the airplane for $800 down, the balance paid off over 24 months starting at $248 the first month and declining slightly each month afterward. Balance of the note is due at the time of the twenty-fourth payment.

Helicopters Used for Industry Rush Cargo

Pittsburgh, Pa.—Helicopter service, using a Hiller 12C helicopter provided by Industrial Helicopters, Inc., handled its first emergency shipment from a new rooftop heliport at Westinghouse's East Pittsburgh plant. The shipment, a replacement lightning arrester for the Illinois Power Co., was rushed to the Greater Pittsburgh Airport for transfer to an airliner.

The helicopter service from Westinghouse can handle shipments up to 500 lb. Cargo is carried between the landing gear skid or in two hoppers attached to helicopter's side.

Takeoff Assist

To get fully loaded floatplanes "on the step" quickly when lake surface is glassy, operator Gordon Mitchell, Flin Flon, Manitoba, developed motorboat tow assist using a 40-hp. Kickhaefer Mercury engine. Tow cable releases automatically when seaplane reaches 30 mph.

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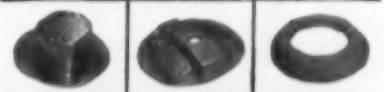

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Engine Maintenance is a must — even under severe winter conditions. With efficient portable heaters on the job, mechanics on this engine test stand are able to make necessary adjustments and repairs — impossible under usual sub-zero conditions. Instant portable heat solves the problem.

Space Heating, temporary or partially completed structures become usable when Herman Nelson portable heaters move in to furnish quick, unfailing heat. Serving the Defense Establishment everywhere is Herman Nelson's major task. Put 16 years of experience to work on your next portable heating or ventilating problem.

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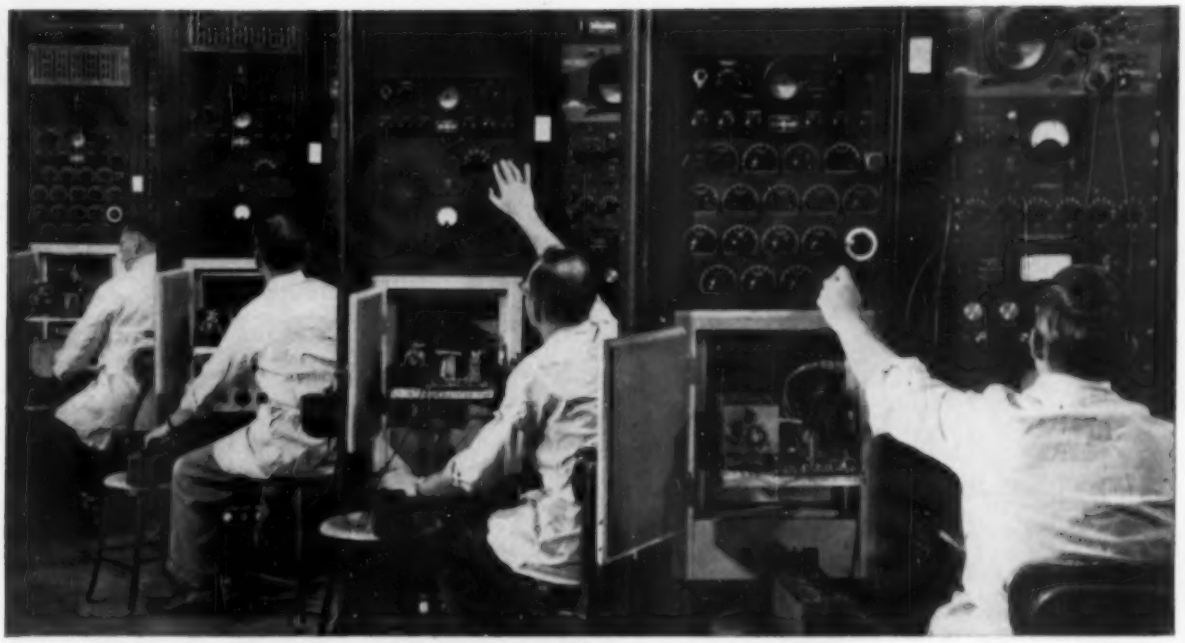

Bendix-built production test equipment calibrates precision induction rate generators and temperature compensating networks as a team.

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The photo above shows the extensive production facility used to test Bendix induction rate generators and temperature-compensating networks as a matched pair. It's your assurance that precision rate generators you buy from Bendix will have the accuracy of laboratory-built instruments. Yet we produce them at almost assembly-line speed.

Extensive calibration enables us to promise generator accuracy within .15 of 1 per cent up to 3,600 rpm, unmatched in a production model such as this. Actually, at 4 volts and 3,000 rpm—the range at which the instrument will more commonly operate—linear accuracy is even greater: within .05 of 1 per cent.

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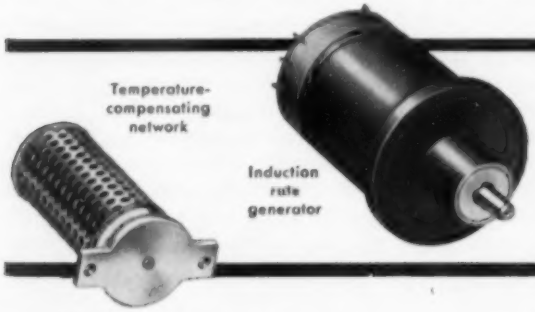


AVERAGE ELECTRICAL CHARACTERISTICS

Rated excitation	115 volts, 400 cycles
Output voltage gradient	2 volts per 1000 rpm
Output voltage	6 volts ± 0.05% at 3000 rpm
Phase shift	0 ± 0.1 degrees

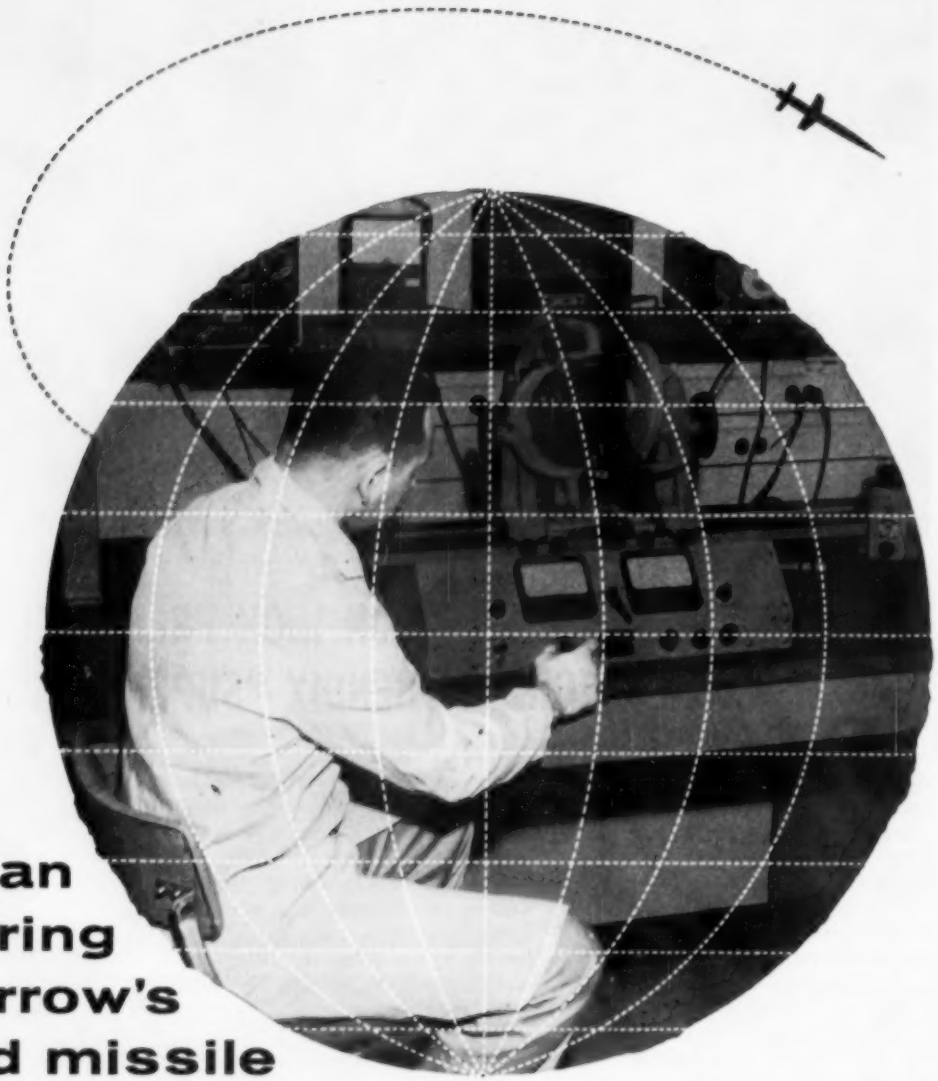
AVERAGE MECHANICAL CHARACTERISTICS

Rotor moment of inertia	0.57 oz.-in.²
Operating temperature range	-15°C. to 75°C.
Weight:	
Rate generator	1¾ pounds
Compensating network	⅛ pound

Eclipse-Pioneer Division

TETERBORO, N. J.

Bendix
AVIATION CORPORATION



This man is steering tomorrow's guided missile

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First Redstone Unit Completes Its Training

Huntsville, Ala.—Redstone missile is scheduled to become the basic weapon of an operational Field Artillery unit here this week for the first time. This unit, the 40th Field Artillery Missile Group (Heavy), will complete its training cycle at the Army Ballistic Missile Agency and then be prepared for deployment overseas. Firing elements of the new unit have been in training at ABMA since April 1956.

The Redstone missile itself is described by the Army as being in the weaponization stage. This phase comes between the development and deployment periods.

The same group is essentially responsible for the missile from inception to obsoleteness. Troops using the Redstone will receive schooling from people who have had development knowledge of the weapon.

First production Redstones will be sent to the Redstone Arsenal. There the same ABMA personnel who have handled the complete test program to date will inspect, test and run the components and complete missile before it is sent to operational units. Some of this work will be a double check on inspections and tests during manufacture but it will make certain that each missile is ready for troop use.

System also serves a purpose in the development phase. The test people will have experience on a larger number of missiles from which to enlarge inspection and adjustment techniques so that a factory type okay will become possible. The goal is eventually to be able to inspect and adjust a missile in the factory so that it can be shipped directly to a field unit for immediate use.

North American Plans Shutdown at Fresno

Fresno, Calif.—North American Aviation will close its Fresno Division by the end of the year when work on present contracts, modification of F-86s, is completed.

Curtailed defense spending has caused a decline in aircraft modification work and has made it impossible to find enough business to keep the plant in operation, W. H. Yahn, general manager of the plant, said.

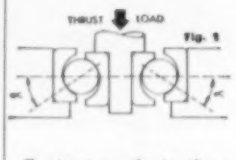
"A number of contracts on which we have been low bidder have not been granted because of government fund allocation problems," Yahn said. "In addition, our studies indicate future aircraft modification business would not justify maintaining our Fresno facility."

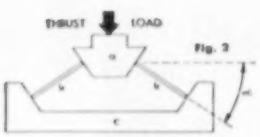
The 1,800 employees will be laid off at an approximate rate of 600 a month.

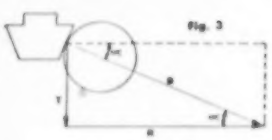
MICRO-BEARING ABSTRACTS

by **A. N. DANIELS,** *President*
New Hampshire Ball Bearings, Inc.

CONTACT ANGLE







Contact angle is the angle between a plane perpendicular to the bearing axis and a line connecting the two points on a given ball where the ball makes contact with the raceways when the bearing is subjected to a pure thrust load. In *Fig. 1*, the contact angle is represented by angle *a*. The significance of the contact angle is revealed by an examination of the forces present in a thrust loaded bearing.

In *Fig. 2*, a simplified version of *Fig. 1*, the shaft and inner ring combination are represented by the plug *a*, the "working diameters" of the balls and represented by the rodlike members at *b*, and the outer ring is represented by the tapered cup *c*.

The contact angle is *a*. This diagram represents a three-dimensional structure with as many equally spaced rods, *b*, as there are balls in the bearing.

The primary concern in design is the amount of compressive force to which rod *b* is subject, which is the force with which a given ball is pressed against the raceways. This force can be calculated by constructing a parallelogram of forces as shown in *Fig. 3*.

The sides T and R, are vector quantities, and diagonal B is the vector sum of T and R. Furthermore, the vector sum of the thrust components on all the balls equals the total thrust load on the bearing. The vector sum of the radial components on all the balls is zero. Vector B, the force actually felt by the raceways and balls, compared to vector T, the thrust component, varies significantly with changes in the size of the contact angle and is directly proportional to the thrust load component and inversely proportional to the sine of the contact angle.

Example I:

A bearing is carrying a pure thrust load of 21 pounds. Assuming seven balls in the bearing, each ball will have an axial load component of three pounds, since a thrust load is shared equally by all the balls. While the axial component on each ball is only three pounds, the actual compressive force, or squeeze, felt by the ball and raceways is considerably greater than this value.

With a contact angle of five degrees:

$$B = \frac{T}{\sin \alpha} = \frac{3 \text{ lbs.}}{\sin 5^\circ} = 34.5 \text{ lbs.}$$

Thus we see that with a five-degree contact angle the actual load felt by each individual ball is actually considerably greater than the total 21 pound thrust load on the bearing.

Example II:

Using the thrust conditions in Example I, the contact angle is increased to 20 degrees, by selecting a bearing with a larger value of radial play.

$$B = \frac{3 \text{ pounds}}{\sin 20^\circ} = 8.78 \text{ pounds}$$

A 15 degree increase in contact angle produced a 74.5% reduction in ball-to-raceway contact stress. This relationship should be noted by anyone who writes bearing specifications. The operational qualities of the bearing, such as low running and starting torque and bearing life, are a function of the ball-to-raceway contact stress. Thus the contact angle is highly significant.

It is not necessary for a bearing user to calculate or specify the contact angle desired. It is only necessary to remember that low values of contact angle are associated with low radial play, and high values of contact angle are associated with high radial play. In addition to the above considerations, gyratory forces become extremely important factors in determining optimum contact angle in high speed applications.

A more complete discussion of contact angle is found in our design handbook.

DESIGNERS HANDBOOK OFFERED *FREE* TO ENGINEERS

If you work with miniature bearings, you'll find this new, 70-page authoritative publication a great help in solving problems in designing instruments or small electro-mechanical assemblies.

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Engineering feats like the Achiever contribute to AC's position of leadership in this complex field of electro-mechanical research and engineering. They account, too, for AC's position as a prime contractor on guidance work for the Air Force in the field of advanced missile systems. Carrying top priority from theory right into production, AC stands ready.

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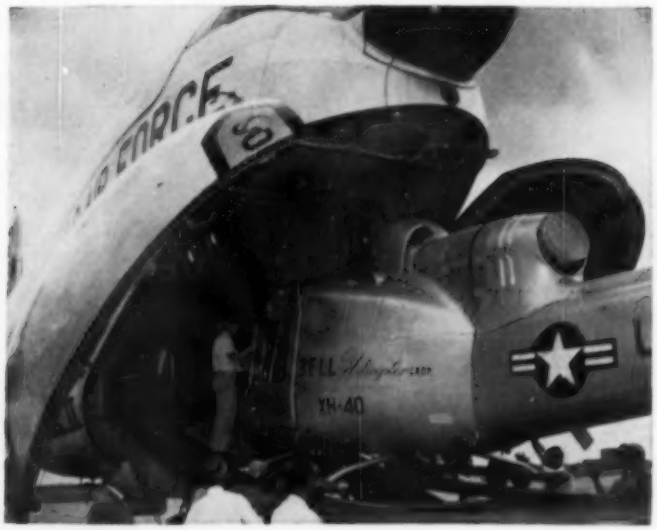
THE ELECTRONICS DIVISION OF GENERAL MOTORS

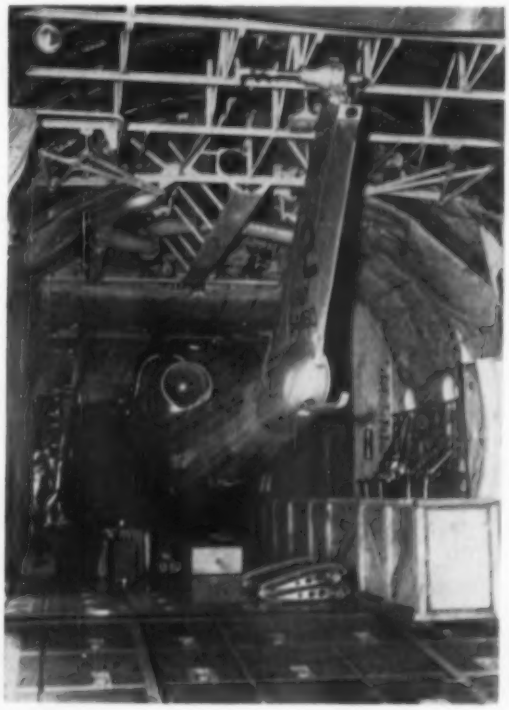
FLINT, MICHIGAN MILWAUKEE, WISCONSIN

Loading of XH-40 into C-124 the first time took three hours. With experience, crew loaded for return trip in 1¼ hr.

Three Transport Types Can Airlift Bell XH-40

Airlift of Bell XH-40 in three different Air Force transports illustrates the air transportability of the new turbine helicopter design. XH-40 was airlifted to Edwards AFB in a C-130 (left and below, right). It returned to Bell's Ft. Worth plant in a C-119. Helicopter was transported to Ft. Rucker, Ala., and back in a C-124 (above and below, left).





New positions in:

MISSILE SYSTEMS AERODYNAMICS

Weapon systems management activities at Lockheed's Palo Alto, Sunnyvale and Van Nuys organizations call for major achievement in aerodynamic areas such as: Theoretical and experimental investigations of the aerodynamic characteristics of missiles at Mach numbers through the hypersonic range; optimization of controlled missile performance, specification and supervision of experimental aerodynamic investigations required to verify and improve missile and weapon system design; analysis and interpretation of aerodynamic flight test data. Inquiries are invited. Please address the Research and Development Staff, Palo Alto 17, California.

Here members of the Aerothermodynamics Staff discuss heating of jet control surfaces. Left to right: W. E. Brandt, thermodynamic analysis; M. Tucker, Aerothermodynamics Department head; R. L..Nelson, project aerodynamics; B. W. Marsh, aerodynamics; J. I. Osborne (back to camera), aerodynamics.

Lockheed MISSILE SYSTEMS

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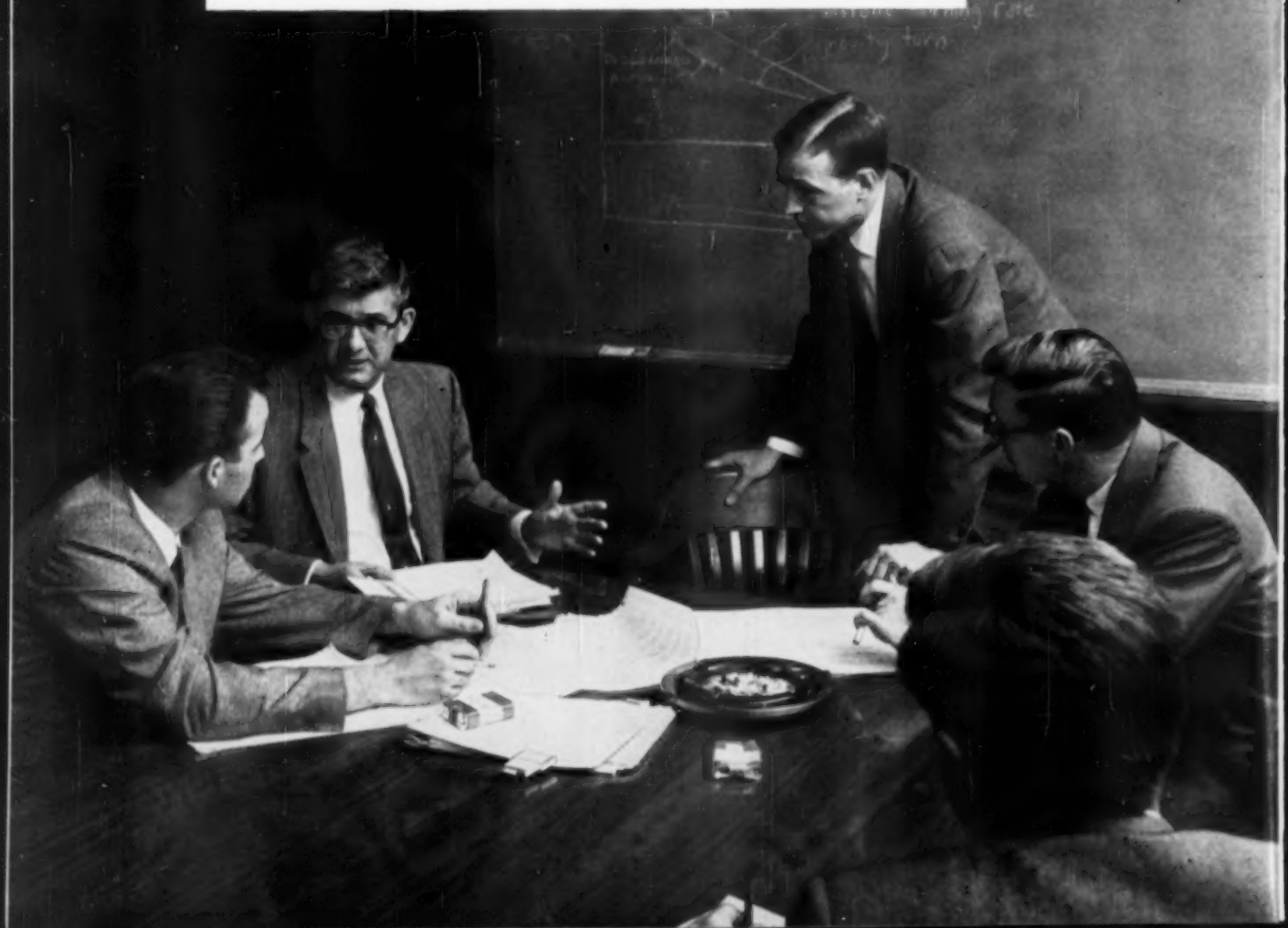
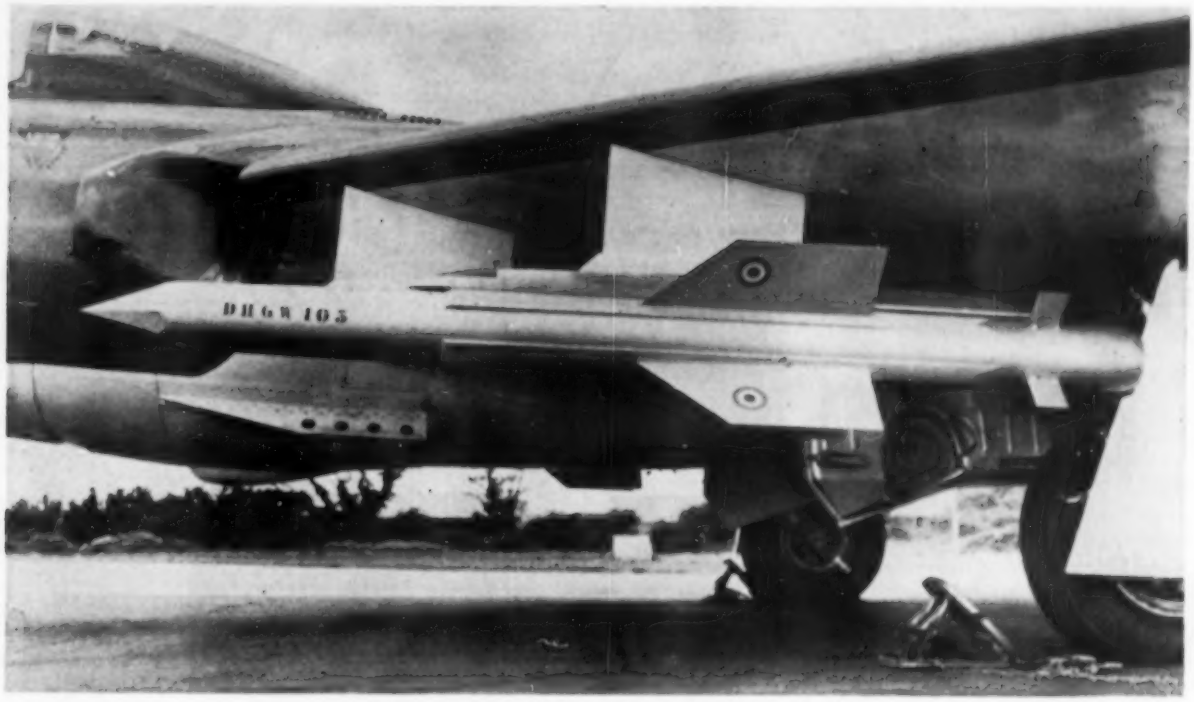




Firestreak Has Beveled Nose

Most sophisticated missile shown at Farnborough (AW Sept. 9, p. 26) was de Havilland Firestreak which uses infrared homing. Though beveled nose differs, air-to-air weapon otherwise is similar to Philco Sidewinder in design concept—a solid propellant rocket used as a basic body shell and powerplant with fixed lifting surfaces, control and guidance packages at nose and tail. Missile here is mounted on DH Sea Vixen. Other Firestreak installations are on English Electric P.1 and Gloster Javelin (AW, Sept. 9, p. 26).

USAF Contracts

Following is a list of unclassified contracts for $25,000 and more as released by Air Force contracting offices:

BASE PROCUREMENT OFFICE, EGLIN AFB, FLA.

Gulf Power Co., Pensacola, Fla., electric power service for Eglin AFB, Fla., AF 08 (603)-254, $79,584.

WARNER ROBINS AMA, Robins AFB, Ga.

Hot Shoppes Caterers Inc., Washington 1, D. C., operation of base dining halls at Robins AFB during Fiscal 1958, (IFB 57-186, local purchase), $165,196.

CAMBRIDGE RESEARCH CENTER, ARDC, Laurence G. Hanscom Field, Bedford, Mass.

Ball Brothers Research Corp., Boulder, Colo., research and development directed toward the flight of two (2) biaxial pointing controls in Aerobee rockets, AF19(604)-2656, $49,813.

Airborne Instruments Laboratory Inc., Mineola, N. Y., design, development and construction of a 425 Mc.s receiver, AF19 (604)-2650, $39,245.

TRG Inc., New York, N. Y., development of the periodic shock wave technique and its application to the preparation of semiconductor silicon carbide, AF19(604)-2665, $46,385.

Barnes Engineering Co., Stamford, Conn., development of three amplifiers, AF19(604)-2669, $29,995.

Airborne Instruments Laboratory Inc., Mineola, N. Y., design, development and construction of a highly stabilized UHF receiver, AF19(604)-2445, $36,796.

Pacific Division, Bendix Aviation Corp., North Hollywood, Calif., services necessary to design and develop airborne telemetering canisters, a remote command system and renovation of an existing receiving station trailer, AF19(604)-2263, $219,337.

Regents of University of California, Berkeley, Calif., study of terrain effects on low level wind and temperature profiles, AF19(604)-2424, $35,000.

Barnes Engineering Co., Stamford, Conn., design and construct a universal type spectrometer, AF19(604)-2653, $45,863.

Daystrom Instrument Division, Daystrom Inc., Archbald, Pa., transistorizing of certain units, AF19(604)-2652, $28,957.

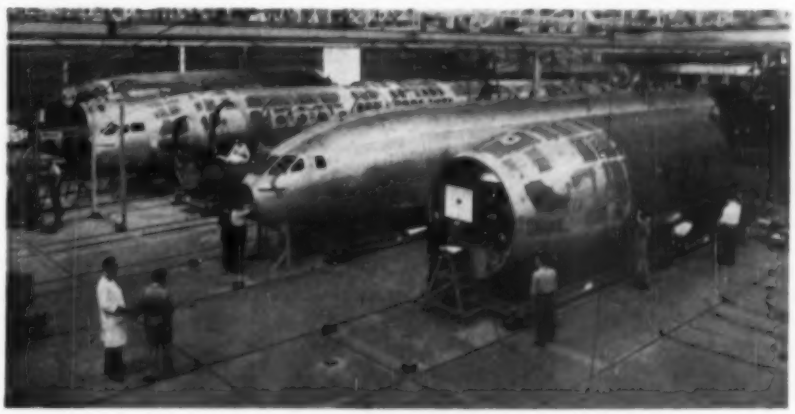
Perini Corp., Framingham, Mass., repair and rehabilitation of runway 11-29, project Ca-82-7, lump sum, (IFB 19604-57180), $966,277.

AIR FORCE MISSILE TEST CENTER, ARDC, Patrick AFB, Fla.

Technical Engineering Co., Philadelphia 34, Pa., additional services and supplies, (PR 57-1392), $33,915.

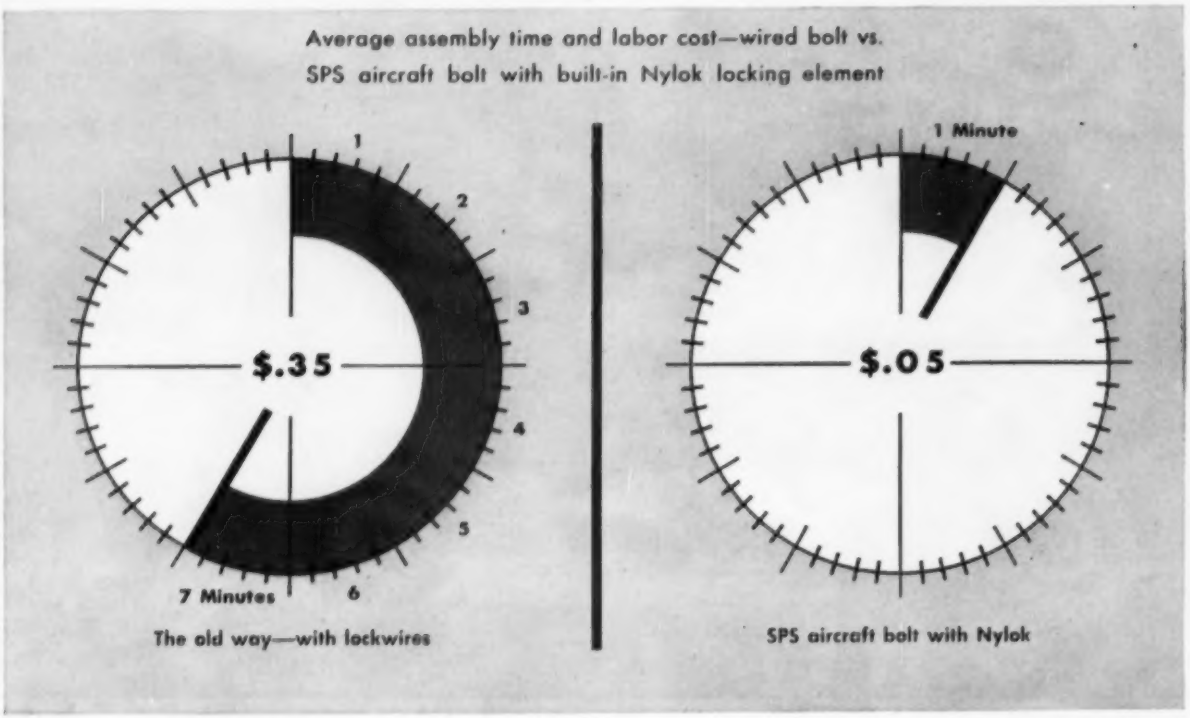
Tesco Chemicals Inc., Atlanta, Ga., ammonia, technical, 6830-264-6747, 200 lb. cylinder, services and materials for hydrostatic test of cylinders, 900 cylinders and services and materials to furnish new valves and repair valves, 2000 cylinders, $30,960.

Gertsch Products Inc., Los Angeles 16, Calif., frequency multiplier, meter and di-



Comet IVs Take Shape

Fuselages for de Havilland Comet IVs for British Overseas Airways Corp. are assembled at manufacturer's Hatfield plant. Five are visible in foreground on assembly tracks. Sixth, in background, has left track for equipment bay. No. 7 of the four-jet transports has gone to erecting shop.



New SPS self-locking bolts with Nylok* reduce assembly time and labor cost 85%

Separate locking devices eliminated

Only one operation is required to fasten aircraft assemblies with SPS self-locking bolts . . . installing the bolts. No lockwashers, cotter pins or wires are necessary. The built-in Nylok locking pellet forces mating threads together and holds tight. You save the cost of separate locking devices and, far more important, the time and labor it takes to install them. The saving in the case of a wired assembly is 85% by test.

SPS engine and airframe bolts with the built-in Nylok locking element also help you reduce maintenance costs. Disassembling a wired installation, for example, involves cutting the wires, removing fragments, and finally removing the bolts. With SPS self-locking bolts there is again only one step—removing the bolts. Because of the "plastic memory" of the nylon pellet, these self-locking bolts can be reused at least 15 times—generally more. They still retain full locking power in spite of violent vibration.

All externally threaded SPS aircraft fasteners are available with the Nylok self-locking element. For complete information, write Aircraft Products Division, STANDARD PRESSED STEEL CO., Jenkintown 3, Pa.

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

BEFORE ASSEMBLY. The nylon pellet projects slightly. When assembled, threads will be impressed into it. The tough, resilient pellet forces mating threads together, locks securely wherever wrenching stops.

AFTER REMOVAL. "Plastic memory" of the nylon pellet has expanded impressed threads to greater diameter than the screw threads. Screw can be used repeatedly. In use, "memory" keeps threads tightly locked.

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Aircraft Products Division **SPS** **Jenkintown • Pennsylvania**

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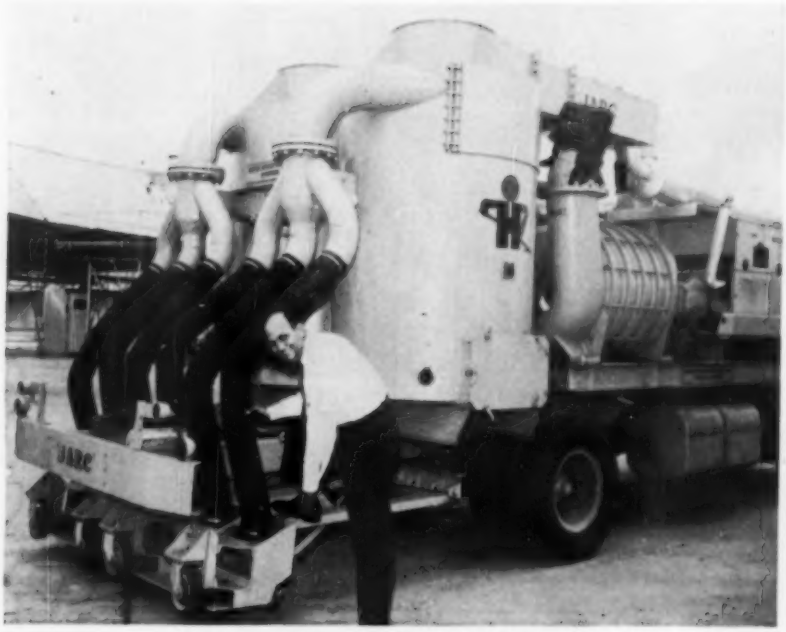

Hustler Runway Cleaner

This oversize runway vacuum cleaner, called JARC for Jet Aircraft Runway Cleaner, is now in operation at Convair's Fort Worth plant. Primary job is to clear debris from runways, taxi areas and ramps prior to flights of the supersonic B-58 Hustler bomber. Machine, which will clean a swath eight feet wide at about 25 mph., does the job previously requiring 30-40 men and does it better. JARC was manufactured by U. S. Hoffman Machinery Company, Syracuse, N. Y.

vider, supplies, (PR 17C-58-1066, 1067, 1069), $40,922.

ROME AFD, Griffiss AFB, N. Y.

Reeves Instrument Corp., New York, N. Y., navigational computer, CP-67 (RFQ 30-635-57-4906), $90,754.

Vitro Laboratories Division, Vitro Corp. of America, West Orange, N. J., automatic data recording unit, model R-065-1A-1, automatic data recording tape handling kit, model R-065-1B-1, (REP 30-635-57-4320Q), $218,393.

MIDDLETOWN AMA, Olmstead AFB, Pa.

Wright Aeronautical Division, Curtiss-Wright Corp., Woodridge, N. J., overhaul of J65 series, RFP PR MA-8-02A-18, $1,707,000.

SHELBY AF DEPOT, Wilkins AF Station, Shelby, Ohio.

David Clark Co., Inc., 360 Park Avenue, Worcester 2, Mass. Coverall: flying high altitude type MC-3, with 2 pr. of underwear; 1,095 ea. (RFP 33-602-57-3086) $197,483.

The Berger Brothers Co., 135 Derby Ave., New Haven 7, Conn. Glove: flying high altitude, type MG1; 1,629 pr. (RFP 33-602-57-3086) $46,475.

TOPEKA AFD, Topeka AFS, Topeka, Kan.

Carbide and Carbon Chemicals Co. Division, Union Carbide and Carbon Corp., New York 17, N. Y., methanol, 504,000 gals., (IFB 14-604-57-717), $155,610.

Engis Equipment Co., Chicago, Ill., microptic theodolite, 28 ea., auto-collimating collimator, 56 ea., auto collimator, 14 ea., (RFP 14-604-57-5827), $140,375.

E. I. Du Pont de Nemours & Co. Inc., Wilmington, Del., methanol, 80,000 gals., (IFB 14-604-57-717), $28,400.

OKLAHOMA CITY AMA, Tinker AFB, Okla.

Stratos Division, Fairchild Engine & Aircraft Corp., Bay Shore, N. Y., housing, intermediate, 4577-18217-7, impeller, 4577-1835315, (P.R. OC-7-03F-B52-MM2130), $111,337; fan volute housing, 4577-17327-3, aluminum alloy retainer, 4577-22141-5, studding assembly, 4577-22725-2, (P.R. OC-7-03F-B52-MM2105), $142,875.

Chandler-Evans Division, Pratt and Whitney Co. Inc., West Hartford, Conn., overhaul of fuel assemblies, (P.R. OC-7-03D-J33-MC2282), $266,359.

ELLSWORTH AFB, S. D.

Corner, How & Lee Inc., Rapid City, S. D., repair shop, A&E, 7503, Project SAC, Ellsworth 23-8 (IFB 39-601-57-94), $29,673.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

AVIATION SUPPLY OFFICE, Philadelphia, Pa.

Utica Division, Bendix Aviation Corp., Utica, N. Y., mounting heads, (383/2118-2986 P 6/4/53 Aero), $31,462.

Pacific Division, Bendix Aviation Corp., North Hollywood, Calif., pumps, (383/2150-4413/55 Aero), $45,344.

Pacific Division, Bendix Aviation Corp., North Hollywood, Calif., valve assemblies, (383/2150-4458/55 Aero), $41,352.

Utica Division, Bendix Aviation Corp., Utica, N. Y., wheels, (383/2118-98/55), $40,927.

Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J., controllers, (383/2120-4371/55) $106,004.

Airesearch Manufacturing Co. Division, The Garrett Corp., Sepulveda, Calif., actuators, (383/2110-4366/55), $198,481.

Meckum Engineering Inc., Ottawa, Ill., mast, mooring, air transportation, (383/29065-180 S 3/3/57), $100,188.

Joy Manufacturing Co., New Philadelphia, Ohio, fans, vane avial, (383/2140-1926 E 4/1/52), $54,246.

Allison Division, Aeroproducts Operations

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of General Motors Corp., actuators, (383/2150-477 X 1/1/55), $114,840.

Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J., servo, (383/2120-4428/55), $44,168.

Cagleco Sportswear, Cape Girardeau, Mo., aviators' jackets, (JD-IFB-383-2086-57), $78,702.

Airesearch Manufacturing Co. of Arizona Division, The Garrett Corp., Phoenix, Ariz., spare parts (383/29043-5 S 2/4/57), $142,596.

Hewlett-Packard Co., Palo Alto, Calif., signal generators (MIPR-33-604-7-17C-4498), $696,130.

Eclipse-Pioneer Division, Bendix Aviation Corp., Teterboro, N. J., transmitters, (383/2120-4360/55/Aero), $28,639.

Bendix Products Division, Bendix Aviation Corp., South Bend, Ind., wheel assemblies, (383/2110-4443/55/Aero), $146,347.

General Textile Mills Inc., New York, N. Y., helmets, (JD 383/29045-145 G 3/1/57 Aero), $58,728.

Montrose Division, Bendix Aviation Corp., South Montrose, Pa., switches, (383/2120-4428/55 Aero), $46,653.

Ronan & Kunzl Inc., Marshall, Mich., hose assemblies (JD PREN 11-4234-57), $50,256.

Amenostat Corp. of America, Philadelphia, Pa., amenostats, (JD 383/2110-4367/55 Aero), $32,822.

Grumman Aircraft Engineering Corp., Bethpage, L. I., N. Y., parts for F9F, F6F and AF spares, (383/2110-1736 A 7/1/53 Aero), $25,254.

B. F. Goodrich Aviation Products Division, B. F. Goodrich Co., Akron, Ohio, wheel & brake assemblies, (383/2150-5330 x 1/1/53 Aero), $105,843.

Barber-Colman Co., Rockford, Ill., actuators & gear boxes, (383/2110-4431/53 Aero), $175,353.

General Electric Co., Philadelphia, Pa., assemblies for A4D-1, 2 A/C, (383/2140-26/55 Aero), $297,137.

SIXTH NAVAL DISTRICT, U. S. Naval Base, Charleston, S. C.

Nat. G. Harrison Overseas Corp., Miami, Fla., additional base facilities for Air Force Missile Test Center Offshore Facilities at San Salvador Auxiliary AFB, San Salvador Island, Bahamas, NBy-10333, $148,800.

Henry E. Damon, Meridian, Miss., engineering services for the performance of field surveys and plotting cross sections and computation of earth quantities, U. S. Naval Auxiliary Air Station, Meridian, Miss., (MBy-13888, $40,000.

Engineers Labs, Inc., Jackson, Miss., engineering services for soils consultation and concrete testing at Naval Auxiliary Air Station, Meridian, Miss., (MBy-13901), $75,000.

U. S. NAVAL AIR STATION, Pensacola, FLA.

Precision Aeromotive Corp., Houston, Texas, rental of crankshaft equipment, (N240s-33064) RFQ-204-723-57, $55,300.

NAVY PURCHASING OFFICE, Washington, D. C.

Trans-Ocean Airlines, Oakland, Calif., operation and furnishing of transcontinental airfreight airlift service capable of transporting a minimum of 20,755 lb. of cargo together with all accessorial services incident thereto. (N600(SA)45693) (Negotiation Number 809-57Q). Estimated mileage, 2,902,800, $2,567,680.

NAVAL AVIONICS FACILITY, Indianapolis 18, Ind.

General Electric Co., 2600 Far Hills Ave., Dayton, Ohio, capacitors, spec. MIL-C-3965, N163-5466 (110990), $25,900.

Gamewell Co., 128 Chestnut St., Newton Upper Falls, Mass., potentiometers, N163-5421 (9854 (A) B), $46,308.

New Hampshire Ball Bearings, Inc., 20 Grove St., Peterborough, N. H., ball bearings, N163-5456 (9150B), $31,568.

Westinghouse Electric Corp., 32 N. Main St., Dayton 2, Ohio, Ammeter-portable type DC Westinghouse model PX-5, style No. 701389 200 ea. Voltmeter portable DC Westinghouse style No. 1728698, type PX-44 177 ea. PR's 80009, 80761, 676084 & Amd #1 $100,202.

Control Products, Inc., 306 Sussex St., Harrison, N. J. Switch-thermos, SPST; Control Products, Inc. Type ASA13-1-15,

Larger Ingots

Allegheny Ludlum Steel Corp., Watervliet, N. Y., is now able to produce 2,000,000 ingot lb. of super-alloys by the consumable electrode melting process. Shown is a 12,000 lb. ingot of super-alloy, believed to be the largest ever produced by this process. Virtue of the vacuum melting process is that it produces a base billet material clean and homogeneous enough to provide superior ductility, Allegheny said. The larger billets now available will mean that larger one-piece forged parts needed for turbine wheels for jet engines and landing gears for large transports will now be possible.

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Sub-miniature . . . hermetically sealed . . . space saving, this HG-E2 relay measures 1" square by 31/32" . . . meets MIL-R-5757C. Designed for operating temperatures up to 125°C. with long-life characteristics at rated contact loads of 2 amps at 28 Vdc or 115 Vac. Coil resistance ranges of 50 to 10,000 ohms. Hook terminals or straight pins for plug-in and printed circuit applications are standard. Available in Form A, B, or C contact arrangement with maximum of two poles . . . for AC operation with internally mounted silicone rectifiers.

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Fairchild Acft. Co. P/N 201066, Appl. C-119 B-66 7,000 ea. RFP 33-604-57-2669 $82,250.

Sensitive Research Instrument Corp., 310 Main St., New Rochelle, N. Y. electrostatic voltmeter, range 5/10/15/20 KV, Sensitive Research Model ESH, 145 ea. Photographs w/one negative, glossy, 3 ea. Data 150 ea. RFP 33-604-57-2581 $54,410.

Amperex Electronics Co. Div., North American Philips Co., Inc., 230 Duffy Ave., Hicksville, Long Island, N. Y., tube, electron RF, MIL 5894 a/w Spec MIL-E-1C dtd 3 Oct 55, suppl #1J dtd 30 Nov 56 and ISS MIL-E-1/152 dtd 20 May 53 2,700 ea. RFP 33-604-57-2503 $47,250.

Eitel-McCullough Inc., 798 Mateo Ave., San Bruno, California, tube, electron, power, tetrode, type 4X150G a/w Spec MIL-E-1C dtd 3 Oct 55 suppl #1H thereto dtd 11 Oct 56 & SS MIL-E-1/302D dtd 5 Dec 55 2,500 ea. RFP 33-604-57-2287 $95,625.

Admiral Corp., 3800 W. Cortland St., Chicago 47, Ill., cable assembly, radio frequency coaxial RG-58/U, P/O RT-178/ARC-27 Collins Radio P/N 505033003 3,292 ea. line R F Transmission, P/O RT-178/ARC-27 Collins Radio PN 5049038002 16,398 ea. RFP 33-604-57-2501 $35,309.

Telectro Industries Corp., 35-16 37th St., Long Island City 1, N. Y., signal generator SG-1A/ARN 142 ea. Power supply PP-348/ARN a/w MIL Spec MIL-P-4295A (USAF) dtd 23 Jul 53 30 ea. Photographs w/1 negative, glossy 3 ea. IFB 33-604-57-396 $134,913.

Transitron Electronic Corp., 168 Albion St., Wakefield, Mass. Rectifier, BuOrd Dwg. 1368663, Revision A and BuOrd Dwg. 136-8871, Revision A, N163-5527 (11096B), $41,-230.

DISTRICT PUBLIC WORKS OFFICE, Ninth Naval District, Bldg. 1-A, Great Lakes, Ill.

Industrial Brownhoist Corp., 135 Washington Ave., Bay City, Mich., furnishing one wagon mounted crane for Cape Canaveral, Fla., (NBY-12623), $107,915.

NAVAL SUPPLY DEPOT, Seattle 99, Wash.

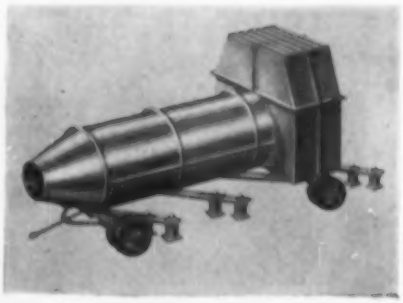
Linde Co. Division, Union Carbide & Carbon Corp., 3404—4th Ave., Seattle, Wash. Oxygen, high purity liquid for use as aviators' breathing oxygen, contract no. N406 (620)40081 (IFB-406-207-57), $32,000.

White Walls for Aircraft

This is the first white wall tire to be produced for aircraft, according to manufacturer, The General Tire & Rubber Company. It is being adopted as standard equipment on executive versions of Fairchild Engine & Airplane Corp.'s F-27 twin turboprop transport. Both sidewalls of the nose wheel are white, but only the outside wall on the main wheel tires. Tires are tubeless and come in 8- and 10-ply ratings.

silencing

FOR JET ENGINES



Maxim, the pioneer name in silencing, now offers dramatic improvements in the design and effective operation of jet engine silencing. Completely portable units, semi portable, or permanent installations are all available through Maxim. Flexibility to meet future engine requirements is a feature of Maxim design thinking. Get the details from the Maxim Engineering Department.

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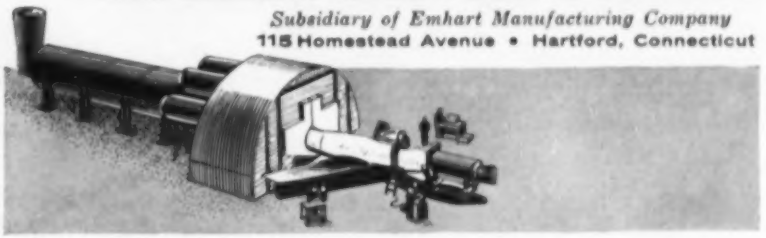

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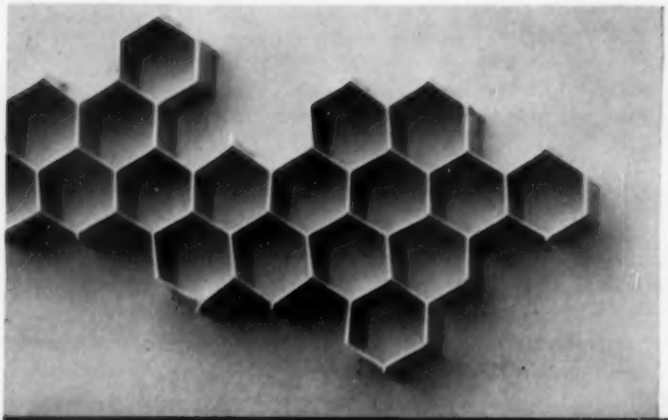

cell structure for the Snark missile

HEXCEL ALUMINUM HONEYCOMB

In designing the USAF Snark SM-62 missile, Northrop engineers specified Hexcel Aluminum Honeycomb for certain principal structural members. And for good reasons. Here are two of them.

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WHO'S WHERE

(Continued from page 23)

Changes

John F. Hicks, assistant to the general manager, Fairchild Guided Missiles Division, Fairchild Engine and Airplane Corp., Wyandanch, N. Y.

Albert J. Seifert, manager-manufacturing engineering, Dalmo Victor Co., Belmont, Calif.

Frank J. Delear, public relations manager, Sikorsky Aircraft, division of United Aircraft Corp., Stratford, Conn. Also: **Sergei I. Sikorsky** has joined Sikorsky's sales staff.

Robert E. Honer, chief electronics engineer, Convair, division of General Dynamics Corp., San Diego, Calif. Also: **Dudley H. Digges,** special assistant-Convair 880 jet transport project.

C. Graydon Lloyd, general manager, Specialty Electronic Components Dept., General Electric Co., Auburn, N. Y.

Norman L. Winter, manager-newly organized countermeasures group, Sperry Gyroscope Co., Great Neck, N. Y.

Leonard H. Seeman, manager-products sales engineering department, Greer Hydraulics, Inc., Jamaica, N. Y.

Lloyd F. Mauldin, project engineer-I/C pneumatics group, Wm. R. Whittaker Co. Ltd., Los Angeles, Calif.

Dr. Charles H. Lutz, chief of advanced design-electronics department, Hamilton Standard, division of United Aircraft Corp., Windsor Locks, Conn.

Martin Boe, air-to-surface missile engineering manager, and **Sanford Falbaum,** assistant manager, Missile Development Division, North American Aviation, Inc., Downey, Calif.

R. R. Garrett, advertising and merchandising manager, Zenith Plastics Co., Gardena, Calif.

J. Allan MacLean, assistant group executive, Bendix Aviation Corp., South Bend, Ind.

William Saxton, sales manager, J. C. Carter Co., Costa Mesa, Calif.

Joseph H. Ehrhardt, technical product development engineer, Marbon Chemical Division, Borg-Warner Corp., Gary, Ind.

Dr. Victor B. Corey, head-marketing program, Donner Scientific Co., Concord, Calif.

Bernard R. McCarthy, sales engineer, Semiconductor Division, Sylvania Electric Products, Inc., Woburn, Mass.

Richard A. Brown, manager-service engineering, Minneapolis-Honeywell's inertial guidance plant, St. Petersburg, Fla.

James Miles, director-engineering services, Control Data Corp., Minneapolis, Minn.

Wallace V. Quigley, contracts manager, Cleveland Pneumatic Tool Co., Cleveland.

William E. Worcester, manager-aircraft sales, Pacific Coast Division, L.O.F. Glass Fibers Co., Burbank, Calif.

Dr. M. W. P. Strandberg, chairman-technical advisory committee, Advance Industries, Inc., Cambridge, Mass.

Raymond Davis, assistant chief engineer-systems, BJ Electronics, Santa Ana, Calif.

Anthony Drabicki, chief application engineer-fluid systems and components, The Waldorf Instrument Co., division of F. C. Huyck & Sons, Huntington Station, N. Y.

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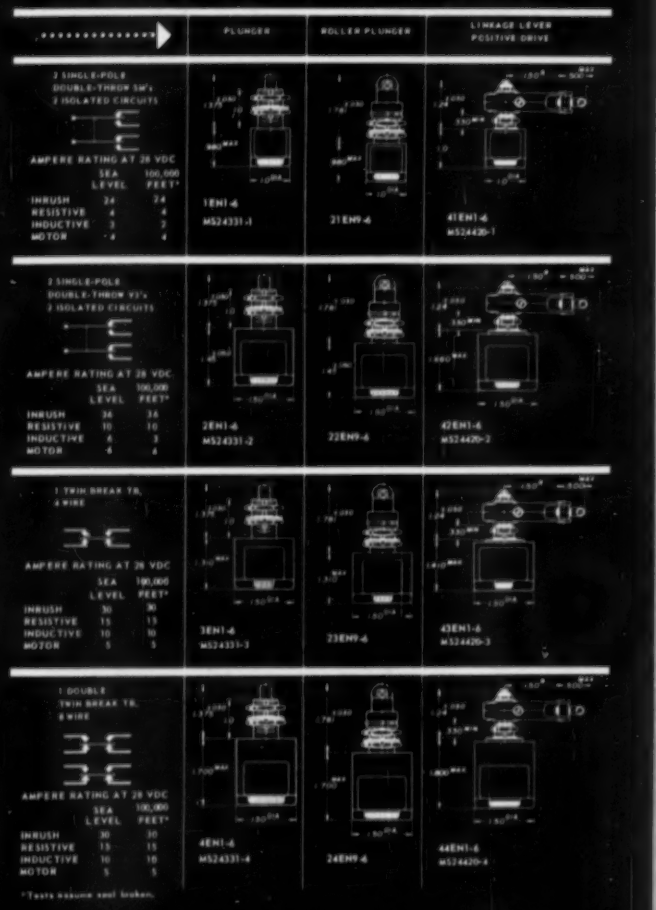
Note the advertisement reproduced on the opposite page. It appeared in August 1941—sixteen years ago. MICRO SWITCH was first in aircraft even then.

Illustrated are twelve of the "EN" series switches. This series constitutes the outstanding aircraft switches today.

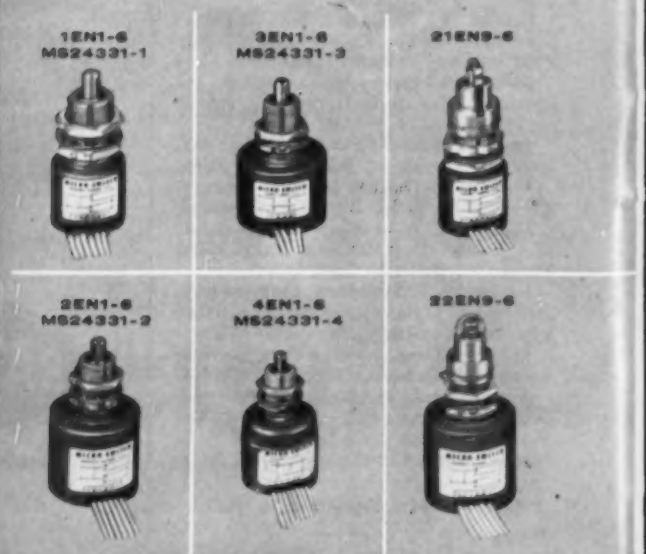
They are rugged, reliable, environment-proof and easy to mount. For details, which space prevents listing, ask for catalogs 77 and 78.

MICRO SWITCH "EN" Series Switches



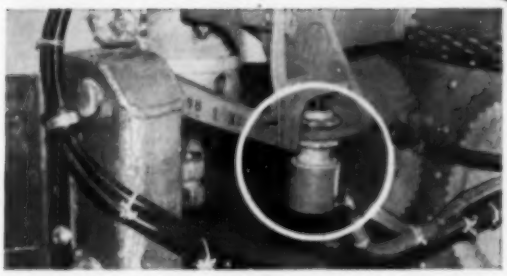
MECHANICAL

	Operating Force	Full Overtravel Force	Release Force	Pretravel
1EN1-6	6-12 lbs.	30 lbs. Max.	4 lbs. Min.	.040 Max.
21EN9-6	6-12 lbs.	30 lbs. Max.	4 lbs. Min.	.040 Max.
41EN1-6	—	—	—	—
2EN1-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.050 Max.
22EN9-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.050 Max.
42EN1-6	—	—	—	—
3EN1-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.060 Max.
23EN9-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.060 Max.
43EN1-6	—	—	—	—
4EN1-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.070 Max.
24EN9-6	6-12 lbs.	30 lbs. Max.	5 lbs. Min.	.070 Max.
44EN1-6	—	—	—	—



Switches have uses unlimited

This advertisement appeared in August 1941. It showed wide use of MICRO SWITCH Precision Switches in aircraft at that time.



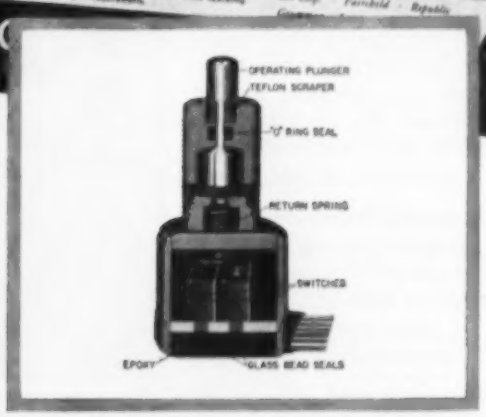
MOUNTING IS SIMPLE—AND RUGGED!

One of the many "EN" type switches used on the Lockheed C-130 Transport is applied to the up-and-down lock on the landing gear—Mounting is simple and rugged. Two .812 inch x .12 inch hexagon nuts, one lock washer and keying washer hold switch securely . . . Switch can be turned so #20 wire, 6-foot terminal wires can be run in any direction.

Only Absolute Dependability Could Gain THIS Preference!
FEATURES
Micro Switches are the choice of these manufacturers!

CHARACTERISTICS

Differential Travel	Overtravel	Weight (without leads)	Operating Torque
.020 Max.	.250 Min.	2¾ oz.	—
.020 Max.	.250 Min.	4 oz.	—
12° Max.	—	4¾ oz.	1 in. lb. Max.
.035 Max.	.250 Min.	6½ oz.	—
.035 Max.	.250 Min.	5½ oz.	—
12° Max.	—	4¾ oz.	1 in. lb. Max.
.035 Max.	.250 Min.	4 oz.	—
.035 Max.	.250 Min.	5 oz.	—
20° Max.	—	4¾ oz.	1 in. lb. Max.
.045 Max.	.250 Min.	4¾ oz.	—
.045 Max.	.250 Min.	5¼ oz.	—
20° Max.	—	5¼ oz.	1 in. lb. Max.



ENVIRONMENT-PROOF—HERE'S WHY

Rugged construction insures reliable performance of "EN" series switches . . . Sealed from the effects of atmospheric changes—humidity, temperature and altitude. Metal housing is evacuated and filled with dry nitrogen gas under pressure. Entrance of dust, air, water, or oil is prevented by a seal. Teflon ring at base of actuator keeps plunger clean and operable at all times. Withstands shock test of 50 G's minimum.

23EN9-6

41EN1-6
MS24420-1

43EN1-6
MS24420-3

24EN9-6

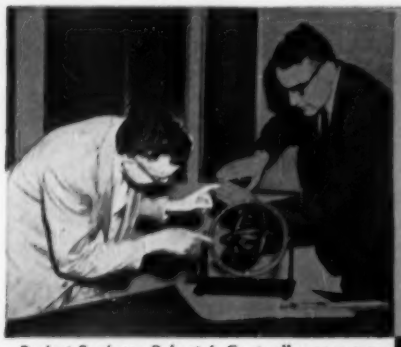
42EN1-6
MS24420-2

44EN1-6
MS24420-4

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

In Canada, Leaside, Toronto 17, Ontario FREEPORT, ILLINOIS



Project Engineer Robert J. Cantwell uses a system of gimbals to describe navigational problem in the analysis of a new system design.

Development Engineer J. Robert Holmes computes, with other systems reliability analysts, the operational worth of a bombing system.

Staff Engineer William Howard reviews gearing accuracy requirements of test equipment with electronic circuit designers.

Circuit Development Group Leader Ralph Wolcott considers future changes in computer output unit for bombing-navigational systems.

Development Engineer John Walsh discusses the use of a recording storage tube at IBM's Airborne Computer Laboratories, Owego, N. Y.

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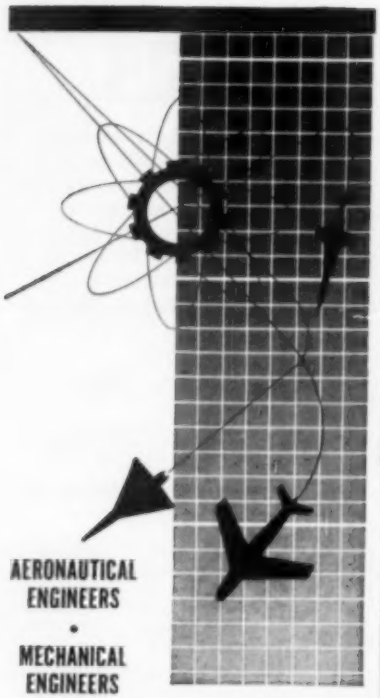

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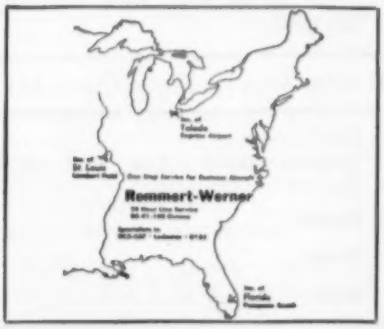

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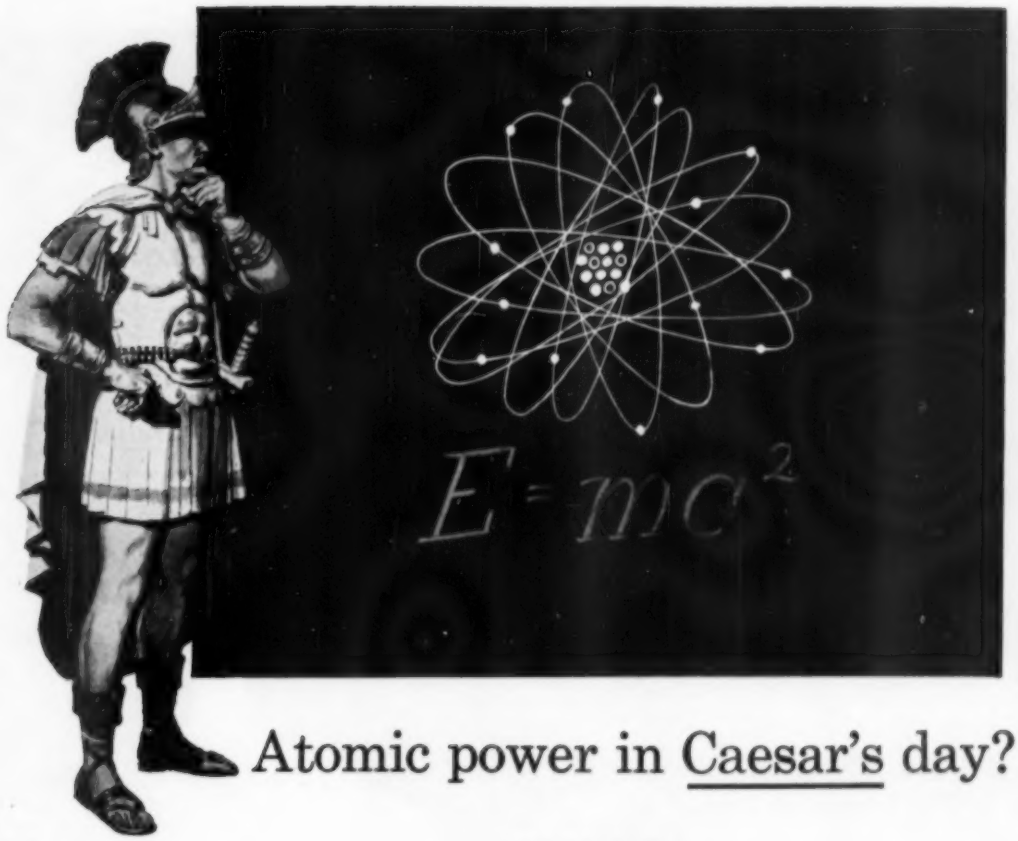

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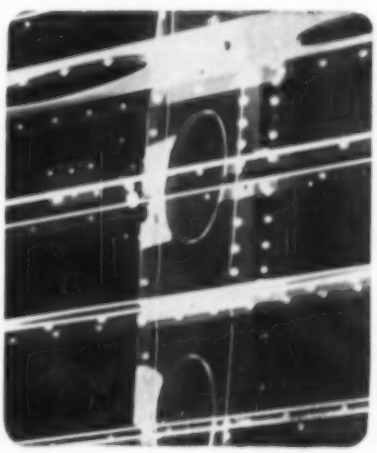

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LETTERS

CAA Answers Bristol

The AVIATION WEEK issue of Aug. 5 carried an article, entitled "Bristol Pushes Gear Changes To Meet Northeast Schedule" (p. 67), which leaves the impression that the Civil Aeronautics Administration was dilatory in keeping the British Air Registration Board fully informed as to the standards required for landing gear on the turboprop Bristol Britannia.

Reference was made to July 4 of this year as the date Bristol was notified that we expected them to comply with existing CAA requirements. Our records show that on Jan. 4, 1957, special conditions for the Britannia Model 300 LR were transmitted to the Air Registration Board noting that condition 24 of the airframe and equipment items required compliance with the pivoting requirements of CAR 4b.235(d). We do not know when these special conditions were transmitted by the ARB to the Bristol Company, but it may be presumed that they were submitted during January of 1957.

We know of no reason why, as your article stated, ". . . Bristol assumed the requirement was not applicable to the Britannia's bogie gear." It may be of further interest to note that until July 1, 1956, the ARB and CAA requirements had been identical, but at that time the British reduced the design conditions for pivoting with modification of the prior conditions. This should help clarify some of the misunderstanding that it would appear has existed as to how this particular item was handled.

WILLIAM B. DAVIS
Acting Administrator
Civil Aeronautics Administration
Washington, D. C.

Sees Cockpit Snafu

Permit me to doff my old leather helmet and Resistal goggles and bow low in honor of the comments of Navy Capt. J. Sinkankas, as reported by Richard Sweeney in the current issue of your esteemed magazine (AW Aug. 19, p. 33). Mr. Sweeney quotes Capt. Sinkankas as describing cockpit instrumentation today as designed for everything but the man who is flying the plane. This is not only true today but has been for some considerable period of time. Only today it is becoming a more serious phenomena as the performance of the airplane places a wider gap between human ability and that of the airplane.

Late last year you gave me the opportunity to discuss with you and your readers this question of flight instrumentation. In the Oct. 29, 1956, issue (p. 68) of AVIATION WEEK some of the recommendations recently discussed by Capt. Sinkankas were delineated in the Avionics Section. At this time I would like to congratulate your reporting of the IAS meeting in general and particularly Capt. Sinkankas for his keen insight into a very serious problem about which apparently very little is being done.

From a technical point of view, I have been interested in this problem for many years, and now since I have a Navy son learning to fly jets I am even more concerned at the gross neglect on the part of those who should be doing something about "coupling" human factors with flight instrumentation through the application of sound principles of human engineering.

More power to Capt. Sinkankas and his fine thinking and to Mr. Sweeney's judicious reporting.

CARL J. CRANE
Helotes, Tex.

Aviation Week welcomes the opinion of its readers on the issues raised in the magazine's editorial columns. Address Letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Fiction Klassified

"How long have you been writing science fiction?" is a question that I'm being asked with increasing frequency in recent months because of science fiction magazine stories appearing under the by-line of "Philip Klass."

Although many of the avionics stories that appear in AVIATION WEEK today might easily have been called science fiction 15-20 years ago, the task of reporting the exciting developments in the fast-moving avionics field is sufficiently challenging, and time-consuming, that I've never even attempted to write science fiction, let alone had any published.

The science fiction author in question, I understand, formerly wrote under the pen name of "William Tenn," but started using his given name recently. Although the first and last names are the same, I believe the middle initial 'J' will alert readers of both AVIATION WEEK and science fiction that the authors in question are not one and the same.

PHILIP J. KLASS
Avionics Editor
Aviation Week

Political Jet Fleet

I'm writing regarding your article on Soviet turbine transports (AW July 22, p. 27). First, I'm afraid your transliteration of the Ukrainian, not Russian, word "УКРАІНА" was incorrect. Had it been correctly transliterated, the significance, especially in the political sense, could be understood. The correct transliteration of "УКРАІНА" is Ukra(ye)na translated "The Ukraine" not "Ukrania." The implied phenomenon could not have occurred during the Stalinist era. Russia was the main and overbearing member of the Union of Soviet Socialistic Republics in his day. Of all the ethnological groups in the world the Ukrainians were the original Russian haters. The original name of "The Ukraine" was Rus. When the great Russians adopted the name Russia, the original Rus's changed their name to Ukraine which in the Slavic languages means borderland, which historically was quite appropriate. These Ukrainians for centuries have dreamed of political automony. But they, like the Israelites, were always on the border of and in the path of various conquerors. The Lithuanians marching South, the Mongols marching west, the Turks marching north and the Poles marching east and south; the Russians under the Tzars and Austrians under the Hapsburgs also had designs on the Ukraine because of its rich farm lands. Also, unfortunately the Ukrainians don't possess a good political sense. During the second World War, Hitler had to go through the Ukraine to get to Stalingrad. Had the Germans not been so imbued with their super-race ideology, they could have enlisted about 40 to 50 million Ukrainians to their cause. The Ukrainian populace always has been a restive group. Stalin attempted to bring them into line by murdering approximately 3 million of them from 1933 to 1936. After the second World War, there were huge purges again against the Ukrainians for their contributions to the Germans.

The present regime in power in Moscow is apparently attempting to placate this rather large segment of captive peoples by the device of naming this particular aircraft "The Ukraine." You mention an aircraft design called "Russia" in your article which may indicate that we may expect a whole raft of various aircraft designs named after some of the so-called republics in the enforced union of the USSR. In reality, a political-historical harangue does not properly belong in an aviation periodical. But almost all of the words and deeds of Soviet heirarchy have political overtones and are, therefore, difficult to escape.

Another example of this is undoubtedly in the design of the My-104 (Tu-104) and My-110. These are modifications of a military design, the Badger. This kept development costs of these aircraft low, and also did not require the services of their best designers on non-military projects for as great a period of time. But like all commercial aircraft which are modifications of military designs, the operating costs become comparatively large; this is due in part to the fact that military designs require greater structural weights which when used commercially become unnecessary dead weight. But, of course, the Russians now have a jet airliner fleet. The fact that economically it could not compete with Western designs on the commercial market does not enter the picture. It has excellent propaganda value since the Russians now have a jet transport fleet and the West does not. Imagine the impact of this fact on the people of Asia, the Arab nations, the people of Africa, and even the uninitiated of the Western peoples. But the economic shoe apparently pinches, because one of the commissars recently made the remark, "Airlines in the United States could not exist without government subsidies."

A general statement from all this might be "The motives of the present Soviet regime are seldom pure," and if one is careful in examining spelling and proper transliteration, more of these rather pathetically transparent devices can be discovered.

BOHDAN I. WANDZURA
Los Angeles, Calif.

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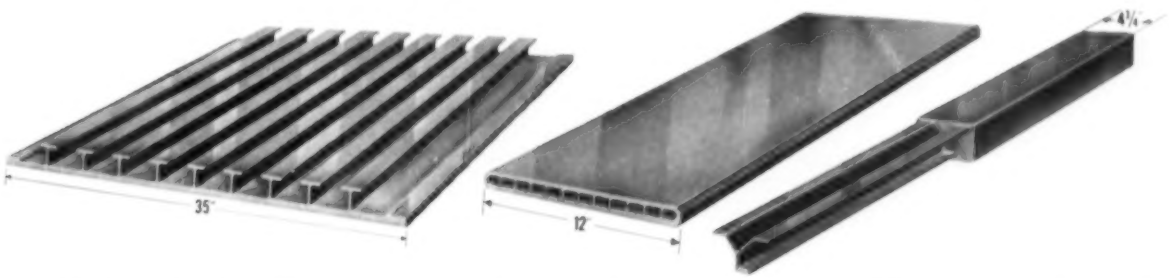

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